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# SCENOGRAPHY AND NEW MEDIA TECHNOLOGIES:

HISTORY, EDUCATIONAL APPLICATIONS AND  
VISUALIZATION TECHNIQUES

by

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University of Warwick



Thesis submitted for the Degree of Doctor of Philosophy  
January 2007



**THESIS CONTAINS**

**CD**



*Посвящается моим родителям,  
Людмиле и Вячеславу ...*

*Посвящается моим родителям,  
Людмиле и Вячеславу ...*



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## **DECLARATION**

**This thesis is all my own work and is in partial fulfilment of the requirement for the degree of Ph.D. in Theatre and Performance Studies.**

## PREFACE

The following publications and conference papers developed from aspects of the research presented in this dissertation:

### **Journal Articles:**

Kuksa, I. At the Interface of Art and Technology: The Dilemma of the Modern Theatre. *Scenography International Journal*, Issue 8, 2007 (in Press).

Kuksa, I. Remediation of Reality and Cultural Values in Digital Age. *Aesthesis*, Issue 1, 2007 (in Press).

### **Conference Presentations:**

Kuksa, I. (2006, August) *Theatre Education and Research of 'The Global Village': Local Project – Global Impact*. Paper presented at the 15<sup>th</sup> IFTR World Congress in Helsinki, Finland.

Kuksa, I. (2005, June-July) *Working at the Interface of Art and Technology: The Dilemma of Theatre Designers*. Paper presented at the IFTR Annual Conference in Maryland, USA.

Kuksa, I (2005, May) *Art, Theatre and Scenography in the Context of Digital Reality*. Paper presented at the International Conference on Scenography in Amsterdam, the Netherlands.



## ABSTRACT

### **Scenography and New Media Technologies: History, Educational Applications and Visualization Techniques**

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Thesis submitted for the Degree of Doctor of Philosophy, January 2007

The endemic presence of digital technology is responsible for numerous changes in contemporary Western societies. This study examines the role of multimedia within the field of theatre studies, with particular focus on the theory and practice of theatre design and education. In the cross-disciplinary literature review, I investigate such primary elements of contemporary media as *interactivity*, *immersion*, *integration* and *hyper-textuality*, and explore their characteristics in the performing arts before and during the digital epoch. I also discuss various IT applications that transformed the way we experience, learn and co-create our cultural heritage. In order to illustrate how computer-generated environments could change the way we perceive and deliver cultural values, I explore a suite of rapidly-developing communication and computer-visualization techniques, which enable reciprocal exchange between viewers, theatre performances and artefacts. I analyze novel technology-mediated teaching techniques that attempt to provide a new media platform for visually-enhanced information transfer.

My findings indicate that the recent changes towards the personalization of knowledge delivery and also towards student-centered study and e-learning necessitated the transformation of the learners from passive consumers of digital products to active and creative participants in the learning experience. The analysis of questionnaires and two case studies (the THEATRON and the VA projects) demonstrate the need for further development of digital-visualization techniques, especially for studying and researching scenographic artefacts. As a practical component of this thesis, I have designed and developed the Set-SPECTRUM educational project, which aims to strengthen the visual skills of the students, ultimately enabling them to use imagery as a creative tool, and as a means to analyze theatrical performances and artefacts. The 3D reconstruction of Norman Bel Geddes' set for *The Divine Comedy*, first of all, enables academic research of the artefact, exposing some hitherto unknown design-limitations in the original set-model, and revealing some construction inconsistencies; secondly, it contributes to educational and creative practices, offering an innovative way to learn about scenography. And, thirdly, it fills a gap in the history of the Western theatre design.

This study attempts to show that when translated into digital language, scenographic artefacts become easily retrievable and highly accessible for learning and research purposes. Therefore, the development of such digital products should be encouraged, but care should also be taken to provide the necessary training for users, in order to realize the applications' full potential.

## LIST OF ABBREVIATIONS

2D	Two Dimensional
3D	Three Dimensional
AI	Artificial Intelligent
AR	Augmented Reality
ARCHEOGUIDE	Augmented Reality-based Cultural Heritage On-site Guide
Bit	Binary Digit
BOOM	Binocular Omni-Orientation Monitor
CAD	Computer Aided Design, Computer Assisted Design or Computer Assisted Drafting
CAVE	Cave Automatic Virtual Environment
CMC	Computer-Mediated Communications
CVEs	Collaborative Virtual Environments
EC	European Commission
eRENA	Electronic Arenas for Culture, Art, Performance and Entertainment
GPS	Global Positioning System
HCI	Human Computer Interface
HE	High Education
HMD	Head Mounted Displays
HRC	Harry Ransom Humanities Research Centre
IDE	Integrated Development Environment
IEVR	Institute for the Exploration of Virtual Realities
IWB	Interactive Whiteboard
IT	Information Technology
KiDDS	Kent Interactive Digital Design Studio
MOMA	Museum of Modern Art
MR	Mixed Reality
RV	Reality-Virtuality
SME	Small and medium-sized enterprise
THEATRON	Theatre History in Europe: Architectural and Textual Resources Online
TV	Television
VA	Visual Assistant Project
VR	Virtual Reality
VRML	Virtual Reality Modelling Language
WWW	World Wide Web
X3D	eXtensible 3D Language
XML	Extensible Markup Language



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## INTRODUCTION AND THESIS STRUCTURE

‘So what are you?’ He drank from the flask, feeling nothing.

‘I’m the matrix, Case.’

Case laughed. ‘Where’s that get you?’

‘Nowhere. Everywhere. I’m the sum total of the works, the whole show.’

William Gibson, *Neuromancer* (1984, pp. 315-316)

Our everyday lives are ruled by computers. In recent decades, technology has diffused into many forms of modern art and theatre. One might argue that new media applications have already become a fundamental part of creative practices and education; however, various aspects of this relatively recent partnership remain to be investigated. This study explores the potential use of *cyberspace* as an interactive experience and educational medium. It develops from the diverse research activities being undertaken in the fields of theatre, art and design history, as well as computer and social sciences, touching upon various sub-disciplines. In order to acknowledge the interdependence and strong communication links between various areas of research, it was necessary to develop and apply novel methodologies and to adopt a new critical vocabulary for discussing rapidly emerging technological innovations. Currently, there is no inherited language to discuss multimedia, thus to avoid using complicated technical terminology throughout this study, I attempt to redefine and simplify the language of this research for the benefit of the readers.

The majority of existing academic sources focus on the historical development of multimedia in theatrical space, as well as their practical application within experimental performance practices. The most significant



current discussions in the area of theatre and set design are concentrated on how technological innovations have been reflected in scenography, and consequently how they have changed the meaning of performance (Grau, 2003, Giannachi 2004, Aronson 2005, Baugh 2005). Most recently, literature has emerged that discusses scenography as 'experimental communication' (Oddey and White, 2006, p.12), which enables the evolution of new performative spaces and their potentials (Reaney 2000, 2000a, Carver and White, 2003). Furthermore, there has been an increasing interest in technology-mediated education within various fields of knowledge, including theatre studies (Beardon 2001, Denard 2004, Beacham 2006). The use of computer technologies for knowledge visualization and transfer has been a contentious topic across disciplines. In the light of recent changes in the accessibility and employability of powerful and now affordable technological devices, this debate has grown in importance and demands critical evaluation. So far, however, there has been little discussion about the importance of the digital reconstruction of historical artefacts, in order to deliver them interactively and creatively. Although the first generation of computer-based educational products has been developed, these applications have received surprisingly little scrutiny. To date, there is no consensus as to how they should be further improved for efficient use in the theatre studies classroom.

One of the limitations of some of the existing research, is the apparent lack of exchange with other disciplines. This thesis attempts to gain fresh insights by pursuing three distinct, but closely interrelated lines of investigation, resulting in the presentation of a practical component that implements some of my theoretical findings, and aligns the present study within existing literature. This practical

work may serve as a template for guiding the future development of software packages for theatre students and researchers.

Firstly, this thesis explores how multimedia and computer technologies have influenced our societies, ultimately producing significant cultural changes. It discusses the historical evolution of new media and identifies various opportunities and challenges that recent technologies present to contemporary theatre designers and educators. Here, I investigate how innovative computer applications can redefine the meanings and boundaries of cultural experience and support new kinds of technology-mediated performance. I pay special attention to the reconfiguration of the established relationship between designers and creative practices, by looking at the history of the technological evolution of theatrical space and by identifying possible tendencies in the future development of the contemporary theatre.

Secondly, I attempt to illustrate how the ongoing and accelerating development of computer technologies stimulates new directions in media research. I explore theoretically, as well as practically, innovative technology-mediated educational methods. I analyze recent changes in teaching and learning techniques and research possible modes of engagement and interaction between the users (learners and participants) and computer-generated environments. In this dissertation, I attempt to examine how new computer technologies challenge the existing processes of knowledge delivery and cultural heritage research, ultimately transforming them into more informative and flexible educational and creative platforms.

Finally, this research attempts to prove the necessity of new modes of delivering visual course material, by analyzing Norman Bel Geddes' *The Divine*

*Comedy* project, as a practical case study. Here, I re-establish and further promote a novel approach to knowledge visualization and transfer, through employing 3D-modelling techniques as a flexible, effective and visually-enhanced means of representation. I attempt to increase the academic community's awareness of new educational possibilities, by actually demonstrating how new computer technologies could contribute to theatre education in general and the research of scenographic artefacts in particular.

## **Thesis Structure**

This thesis comprises seven chapters and a digitally presented (CD), original, educational project, divided into five complementary parts. **Part One** introduces the conceptual background of this study, outlines the main research questions and methods, and defines key-terminologies, which are widely used throughout the thesis. **Part Two** (Chapters One and Two) sets the scene with a general literature review, concentrating on the most significant current discussions and pointing out some neglected aspects, which require further comprehensive investigation. This part provides the theoretical foundation for the following chapters, enabling further analysis and, ultimately, the practical application of the main findings. In pursuance of the above objectives, **Part Three** (Chapter Three) discusses the conceptual base of the study (i.e. the educational aspects of media and computer technologies) and develops the analytical framework for evaluating two case studies, the findings of which will be discussed and applied practically in **Part Four** (Chapters Four, Five, Six and e-Chapter) of the present thesis. Finally, **Part Five** discusses the most significant findings of this study, suggesting several directions for future research.



## RESEARCH QUESTIONS AND METHODS

### Research Questions

There are three main questions raised in this study, supplemented by two subsidiary questions:

#### Research Question 1 (for a full discussion, see Chapters One and Two)

To what extent does the marriage between art and technology influence the ways in which theatrical space is designed, created, perceived, and researched?

##### *Subsidiary Questions to Research Question 1*

(1) Do new computer technologies challenge the very nature of theatre art or do they simply enhance existing practices and traditional scholarship?

(2) How important did new media applications become within the various disciplines (e.g. ethics, aesthetics, audience research, scenography) that have driven the evolution of modern theatre?

#### Research Question 2 (for a full discussion, see Chapter Three)

To what extent do new media communication and interaction platforms transform knowledge delivery and facilitate creativity in the theatre studies classroom?

##### *Subsidiary Questions to Research Question 2*

(1) What are the recent tendencies in the use of computer technologies for creative and educational purposes?

(2) What positive and negative outcomes can be expected when technology-mediated learning is applied?

#### Research Question 3 (for a full discussion, see Chapters Four, Five and Six):

How can 'lost' artefacts be studied effectively?

### *Subsidiary Questions to Research Question 3*

(1) Is there a need for historical theatre artefacts and past productions to be *remediated* and communicated digitally?

(2) How can new computer technologies help in cultural heritage research – i.e. the production, storage and knowledge transfer?

### **Research Methods**

This study adopts a multi-level approach to data collection. With the aim of making robust connections between long-term historical trends and particular instances of recent socio-technical and educational changes, it was decided to employ a suite of different research techniques. Throughout my research work, I have made every possible effort to locate all relevant material, employing mainly qualitative, but also some quantitative research techniques. The methodology of this dissertation evolved through four important phases (also outlined in Table 1 below):

**Phase One: Interdisciplinary Literature Review and Synthesis** (Chapters One, Two and partly Three).

Most previous studies have based their criteria for the evaluation of the theoretical and practical applications of new media technologies mainly on a one-discipline basis or, in other words, without seeking to establish cross-disciplinary links. Although my research also aims to provide the historical and theoretical context for studying the factors that influence socio-technical changes mainly in the field of theatre education and creative practices, I also adopt an interdisciplinary evaluation framework, in order to define and classify the use of multimedia within

various fields of knowledge (e.g. social studies, ethics and aesthetics, computer sciences, art, design, media and theatre history). This study attempts to offer a broader and more systematic mapping of the common ground shared by the aforementioned disciplines, and to apply the findings to strengthen the academic discussion on computer-mediated knowledge delivery for teaching scenography and theatre design history in the theatre studies classroom.

### **Phase Two: Interaction and Evaluation (Chapter Three).**

It was decided that the best method to adopt for investigating the recent tendencies in technology-mediated knowledge delivery is a case studies analysis. Here, I focus on two computer-based educational projects (the THEATRON and the Visual Assistant), aiming to explore whether their novel approach to education and creative training benefits the process of learning and what could be done in order to improve it. The majority of data was collected through my direct interaction with the aforementioned electronic packages. Additionally, I have consulted a wide range of written materials, including a number of testing and evaluation reports on both projects; designed the open-ended questionnaire for the project leaders to complete; and conducted several informal interviews with the members of the THEATRON project's development team. As a result, I have proposed a detailed software evaluation framework, attempting to examine the overall effectiveness of both case studies as novel platforms for knowledge delivery and creative development. This assessment aimed to contribute to the formation of the practical component of this study – the Set-SPECTRUM educational project.



### **Phase Three: Archival Research (Chapters Four and Five).**

Prior to commencing the e-Chapter, extensive archival research was required. It was undertaken at the Harry Ransom Humanities Research Centre (the HRC), at the University of Texas in Austin, the only research centre in the world to contain comprehensive materials on Norman Bel Geddes. At the HRC, all information on Norman Bel Geddes is divided into three series: I. Industrial Design and Theater Files, 1873-1964 (bulk 1915-1958), II. Office and Clipping Files, 1917-1961 (bulk 1945-1958), and III. Personal Files 1870-1959 (bulk 1930-1958). I mostly focused on examining his theatre files – i.e. dramatization, production script for *The Divine Comedy* by Dante Alighieri, translated by Charles Eliot Norton, and *The Divine Comedy* theatre project. Additionally, I explored his original writings, correspondence, publicity documents including, press releases and newspaper articles by and about Bel Geddes, and sources of his design ideas. I also consulted a number of visual materials such as preliminary sketches, drawings, scene renderings, model plans, elevations and original photographs by Francis Bruguière. At my request, all necessary visual and textual sources were scanned, digitally photographed or duplicated, in order to be presented in this thesis.

### **Phase Four: Questionnaire and Procedure (Chapters Five and Six).**

It was considered that quantitative measures would usefully extend the qualitative analysis and supplement the procedure (i.e. development of the practical component). Therefore, I introduced a questionnaire to be completed by the first-year undergraduate students at the School of Theatre, Performance and Cultural Policy Studies in the University of Warwick. The design of the questionnaire was based on a standard template of eleven closed questions, which aimed to assess

the students’ expectations of the study process and whether they could benefit from technology-based education. Finally, another questionnaire (for Marley Porter) was specifically developed, in order to contribute to the discussion of the possible limitations of Norman Bel Geddes’ set for *The Divine Comedy*.

For the procedure, I adopted the following research strategy: (1) identification of the educational concepts, underlying the project; (2) selection of an artefact to be digitally presented in the project’s body; (3) research, evaluation, and choice of appropriate technologies for implementing the project; (4) formulation of a final design and technical outline of the project; and (5) development of the finalized educational package – the Set-SPECTRUM project.

TABLE 1: Research Methods. Author: Iryna Kuksa

Phases of Research	Needs	Methods
Phase One	There is a need for a broader and more systematic mapping of the common ground shared by various fields of knowledge.	Cross-disciplinary literature review – analysis and synthesis of the current research.
Phase Two	There is a need to identify and investigate major tendencies in the area of technology-mediated knowledge delivery.	Direct interaction with chosen electronic packages, open-ended questionnaires, informal interviews, analysis of a wide range of written materials, and development of a detailed evaluation framework.
Phase Three	There is a need to increase the academic community’s awareness of Norman Bel Geddes’ visionary ideas.	Work with original materials – textual and visual. All necessary original sources were scanned, digitally photographed or duplicated for being presented in the thesis.
Phase Four	There is a need to contribute to the development of computer-mediated means of education.	Closed-questions questionnaires, design and implementation of the original educational project.

## TERMINOLOGY

This dissertation uses an *interdisciplinary* or *multidisciplinary* approach to its literature review, or, to be more precise, it integrates various concepts from different disciplines. Therefore, it is necessary to clarify some of the terms, which are used here interchangeably and might embody a multitude of interpretations.

In this thesis, I accept Botler and Grusin's (1999) notion of *remediation* and employ it here to describe the way different types of media converge and one medium gets absorbed by another. Mainly, however, by using this term, I attempt to explain how new technological applications help with the delivery of information and the encouragement of new experiences. While a variety of definitions of novel digital media have been suggested, this study will use the most complete (in my opinion) to date definition suggested by Packer and Jordan (2001, pp. xxx-xxxi). Here, I consider *integration* as 'the combining of artistic forms and technology into a hybrid form of expression', arguing that the performance practice-visual arts marriage has been revealed recently in notions of the *hybrid*. I treat *interactivity* as 'the ability of the user to manipulate and affect her experience of media directly, and to communicate with others through media', and also as the most prominent type of art in the digital age. In the context of this thesis, however, this term is used mainly from an educational (i.e. knowledge delivery) point of view.

*Virtual reality* or *VR* is a term frequently used in the literature, but to date there is no consensus about its definition. A generally accepted definition of VR is a computer simulation of a real or imaginary system that enables users to perform operations in virtual environments and shows effects in real time. It is also a part of the global information and communication infrastructure – *cyberspace*.



Throughout the thesis, the terms *virtual world*, *virtual space*, *virtual environment* and *cyberspace* and *cyber-world* are used interchangeably. In addition, I treat the terms *augmented* and *mixed reality* (*AR* and *MR*) as the perceptual integration of real and virtual space. Mainly, however, I refer to collaborative virtual environments (CVEs), which offer such amalgamation and communication in a form of interactive, computer-assisted learning.

Admittedly, many researchers refer to an interface as a frame. In the context of this thesis, however, I argue that younger generations of technology users will not treat it as such, because they are growing up surrounded by a *frame-interface*, transforming it into an invisible medium or, in other words, providing virtually *interfaceless* experiences. Additionally, this term is interpreted as a *fourth wall* between the user and a digitally-transmitted interactive performance or a navigable computer-based educational package.

It is also necessary to mention that throughout this dissertation, I widely use the term *user* which is interchangeable with such terms as *participant*, *viewer* and also an *audience member*, depending on the context of their use – i.e. technological, educational, or theatrical.

In this thesis, I often use the terms *computer-mediated*, *computer-based*, *technology-mediated*, *technology-empowered* and *technology-based learning*, *study* or *knowledge delivery*. By *computer- or technology-based learning*, *study* or *knowledge delivery* I mean the use of digital educational products which can only be accessed through the computer-medium – i.e. the Internet or CD-ROM. Sometimes, I use these terms interchangeably. The terms *computer- or technology-mediated* or *technology-empowered learning*, *study*, or *knowledge delivery* are compatible and often used in the similar context as the above terms,

but can also imply access to the educational resources through other media such as videoconferencing and interactive whiteboards. Furthermore, in the context of this thesis, I refer to computer-generated educational *settings* as specifically designed virtual environments (pre-recorded or interactive), which encompass any learning or research activities conducted through the medium of a computer.

It is necessary to clarify what is meant by the *closed-questions* questionnaire, two of which were specifically designed to collect valuable for this research data, aiming to prove the necessity of implementing new modes of knowledge visualization in a theatre studies classroom. Their findings are analyzed in Chapter Six of this thesis. In social studies, the majority of questionnaires and semi-structured interviews are presented in this format due to the convenience of data collection and analysis. A *closed* question generally means the 'one where the possible answers are predetermined' (Gillham, 2000, pp. 4-5). For this study, I used closed-questions multiple-choice questionnaires, in order to be able to generalize from the sample findings.

In this dissertation, the terms *set-model* and *stage-model* are used interchangeably mostly to mean Norman Bel Geddes' design concept for Dante's *The Divine Comedy*. I also refer to a term *3D-model* as a three-dimensional, computer-generated reconstruction of the aforementioned set design. There is also a need to clarify exactly what is meant by *artefact* and *lost artefact*. Throughout the dissertation, the term *artefact* is used to refer to historically and culturally important art-objects, including scenic designs and models. The term *lost artefact* describes any missing or destroyed art-object, which left some sort of visual evidence of its existence, such as photographic documentations, sketches, plans,

and elevations (e.g. *The Divine Comedy* set-model, which was lost in the last century).

The use of other terms will be explained in the body of the thesis.



## CHAPTER ONE: AT THE INTERFACE OF ART AND TECHNOLOGY – THE DILEMMA OF THE MODERN THEATRE

‘In the theatre, every form once born is mortal; every form must be reconceived, and its new  
conception will bear the marks of all the influences that surround it.’

(Brook, 1968, p. 19)

Throughout the written history of mankind, the broad concept of what we consider to be *art* was constantly constricted by numerous factors, including individual perceptions or various notions of what is, or is not *art*, which were shared by certain groups of people. From the etymological point of view loosely translated from the Latin, *art* means *arrangement* or *to arrange*. Obviously, there are multiple meanings of the word which are used interchangeably to identify, for example, a painting, as well as a theatrical performance. Indeed, artistic expressions took many forms with a wide range of genres within them. However, since the advent of modernism in the nineteenth century the situation in the art world started changing dramatically towards the use of contemporary technological innovations for art-making purposes. This art-technology marriage gave birth to photography, video, installation, conceptual art, and more recently, digital or cyber-art, virtual performances and computer games. This study argues that it has also changed our overall perception and experience of the world, providing the ground for creative practitioners to (1) boost existing art practices and traditional scholarships and even (2) challenge the very nature of art and theatre through exploring new means for reshaping time and space. The key problem here, is that some of these artists concentrated only on technology and its capability to enhance the quality of presentation, sometimes overlooking the very concept of the art-act; while others completely ignored technological innovations,

defining them as damaging artistic creativity and, as a result, preferring more economic means of expression. Therefore, the issue that needs to be investigated is whether and how the marriage between art and technology can be balanced. I will develop this line of argument throughout the dissertation.

Chapters One and Two contain a multidisciplinary synthesis and critical overview of existing literature and scholarly research – theoretical and practical. In this chapter, I will outline the historical development and present the state of some important technological inventions in the area of contemporary media. For the purposes of the current thesis, the emphasis in this chapter will be mainly on conventional notions of theatre, which is crucial for a thorough analysis of the impact of new media on the live art- and theatre-creation processes. Furthermore, I will investigate *interactivity* as a condition of modern theatre and also explore the issue of *immediacy* in the context of digital reality. I will define *cyberspace* and give some background information on various areas, where digital products have already been and potentially could be implemented. Finally, I will conclude this chapter with a critical discussion of the opportunities and challenges that recent technologies present to contemporary creative practitioners, especially theatre designers, who are involved in the process of producing, storing and transferring theatrical artefacts.

## 1.1 Following the Digital Path...

‘Cyberspace is a word coined in a science fiction fantasy to represent what exists on the other side of the human-computer interface – a world of digitized information that has come to be envisioned as a virtual space, a space for human interaction, a space for work and for play, a space where the barriers of geography, natural forces, and human limitations disappear.’

(LeNoir, 1999, p. 175)

In the context of this thesis there is a need to look at *art* as a process, which widely embraces ephemeral, time-based, visual and performing artistic events that include human presence (i.e. live art), and also broadens, challenges, and questions traditional art views. Within late twentieth century live art, the important turn towards performance practice through visual arts has been revealed in notions of the *hybrid*. This change could also be associated 'with performances shaped overtly by terms uprooted from sculpture, object-related processes or film-production' (Kaye, 1996, p.120). The appearance of a complicated mixture of painting, collage, and, lately, video, theatrical installations and numerous other digital media was a stepping stone to rigorous testing of conventional languages of art. The computerization of the art world and societal life redefined existing cultural forms and led to the emergence of new ones, including multimedia and virtual environments. *Multimedia* appeared as a blend of various types of media including text, graphics, audio, animation and flexibility to convey information, knowledge and, furthermore, new qualities of experience. Packer and Jordan (2001) argue that there are a number of possible readings of new media history, just as there are many possible paths through a network. They also suggest that in order to understand this evolution fully, it is necessary to identify two key-properties of novel digital media, which are, firstly, an *integration* quality that can be explained as a combination of artistic forms and technology into a hybrid form of expression; and, secondly, *interactivity* that enables users to manipulate and affect their experience of the media directly. Furthermore, to appreciate the impact of multimedia on the art and theatre world, it is crucial to define some of its capabilities, which can be described as: (1) *immersion*, or an experience of entering into a three-dimensional (3D) simulated environment; (2) *hypermedia*, or



a synthesis of separate media elements that creates a trial of personal association; and (3) *narrativity*, or an aesthetic and formal strategy that derives from the above concepts resulting in nonlinear story forms and media presentations (Packer and Jordan, 2001, pp. xxx-xxxi). This characterization of digital media is probably the most complete to date. However, there seems to be scope for further elaboration of the above framework, and such advances will help to explore the full potential of digital media applications, and also establish how they influence various cultural, creative and educational processes.

It is hardly surprising that the culture of the modern period with its innovative and interactive dynamism could be regarded as *virtual*, mainly because it leads to the digitization of almost every aspect of everyday life in contemporary society. Manovich (1995, p.1) states that this *virtuality* of our culture should be characterized as ‘the existence of another virtual space, another three-dimensional world enclosed by a frame and situated inside our normal space.’ Indeed, nowadays we are surrounded by computer-generated environments, which are very diverse and serve various purposes, including exposure therapy for driving phobia, surgical operations, and simulations for pilot-training; and, at the same time, providing space for virtual galleries, classrooms and performances. *Cyberspace* emerges as a computer-generated, navigable infinity that seemingly exists behind the computer screen and is able to connect and separate its users at the same time as they are actively engaged in the networked electronic communication. Virtual reality (VR), in its turn, acts as the simulation of real or imagined environments that can be experienced in three dimensions of width, height, and depth. This study considers the crux of the idea of virtual reality is interactivity and suspension of disbelief. However, some researchers (e.g.

Amstutz *et al.*, 2004) are convinced that the emphasis is on graphical and other presentation aspects of VR, rather than on a new medium for exchange. William Gibson, in his 1984 novel *Neuromancer*, for the first time, presented virtual reality as a fact of our daily experiences. He described the computer network as an 'unthinkable complexity – as a cyberspace' (p. 51).

Cyberspace and virtual reality are complex and constantly evolving phenomena; therefore, even today these terms are still open for definition. Botler and Grusin (1999, pp. 179-181), for example, argue that cyberspace is not 'a parallel universe' or 'a place of escape' from contemporary society or from the physical world, but 'a shopping mall in the ether'. They state that the very idea of cyberspace is that it transforms information 'from something separate and contained within our computers to a space we can inhabit'. Indeed, this definition fits smoothly into contemporary networks of transportation, communication, and economic exchange. Certainly, cyberspace is more than simply 3D computer-generated interactive environments. It is a new trend across computer culture and also, as Manovich, (2001) points out, can be considered as a recent standard in human-computer interfaces and computer networks. Although cyberspace is a relatively common idea, it can mean several different types of virtual reality. For example, the movie industry is very good at presenting VR spaces as an analogous world that exists invisibly, and at the same time with our own reality. At present, cyberspace embraces a vast range of existing 3D digital worlds, such as high-end VR works that feature Head-Mounted Displays (HMDs) and photo realistic graphics, arcade, CD-ROMs and on-line multi-player computer games, Virtual Reality Modelling Language (VRML) scenes, and graphical leisure and educational environments. There are numerous definitions and applications of

cyberspace and VR, which can differ from one research area to another. In the context of this thesis, I consider cyberspace as a digitally-created 'parallel' cultural world that contains an immense number of opportunities for creativity, learning and simply interaction. Furthermore, I treat the notion of virtual reality mostly in a literal way, as a means that enables 3D reconstruction and user-VR world-user collaboration. Sometimes, however, these terms will be used interchangeably.

There is little doubt that technological development and its capability to produce constantly new multimedia applications is endless and, furthermore, these applications continuously and irreversibly change human perceptions of the surrounding world, and bring a new quality of experience to everyday life. There are many innovative devices that have already been widely implemented in such spheres as education and training; art (including live art), design and entertainment; scientific research; communication, information and presentation; and also marketing and advertising. It is quite obvious, however, that there is much overlap between them. For instance, collaborative virtual environments (CVEs) offer communication, but also educational activities or, to be more precise, a form of interactive multimedia computer-assisted learning. Furthermore, computer-based simulations allow users to participate in multimedia exhibitions, videoconferences and presentations, and also improve their physical skills in a non-risk environment (e.g. military campaigns). These multimedia applications for conceptual navigation contain numerous digital resources, such as information points and displays, virtual libraries and databases, electronic books, and visualization products for users to utilize. There is also a new dimension of cyberspace which offers its users the possibility to create their digital



representations and join the avatar-inhabited virtual communities. These spaces are considered by some theatre researchers, as a new opportunity to create virtual theatrical performances. It could also be argued, however, that such virtual environments look more like ‘unrehearsed’ computer games than possible theatre venues. Nevertheless, there are numerous other entertainment applications that contribute to the special effects industry widely employed in cinema and theatre, and which allow visualization and testing of various design and architectural projects before implementation or after complete demolition. The examples here might include reconstructions of ancient buildings, historical stages and sets from archaeological and visual evidence, and also the creation of drafts for future theatre productions. These virtual models enable researchers to investigate various objects, which, for instance, are either too large or too small in scale to be explored in real life, or which were lost in the past or do not yet actually exist.

Indeed, the remediation of the world around us continues and quite possibly will never end. One might argue that cyberspace is an ultimate cultural and communication medium and, indeed, it probably is to date. However, the question, which cannot be answered quite yet, is for how long?

## **1.2 Remediation of Reality and Cultural Values in the Digital Age: A Short Historical and Technological Overview**

‘We are witnessing the emergence of a new cultural meta-language, something that will be at least as significant as the printed word and cinema before it.’  
(Manovich, 2001, p. 93)

Botler and Grusin (1999, p. 62) argue that for hundreds of years, the *remediation* of reality has been built into all technologies of representation. In order to

understand fully the emergence and development of the newer media, it is necessary to look into how their historical prototypes evolved in our society. The first large-scale media transformation took place in the fourteenth century, when the revolutionary advent of the printing press resulted in a complete change from how visual culture was previously communicated. Another major scientific and artistic breakthrough was made with the invention of photography in the nineteenth century, which dramatically altered mankind's perception and experience of the world – an effect that continues to this day. One might argue that the media revolution our civilization is experiencing at the moment is more profound than the previous ones. According to Manovich (2001), first of all, it has shifted our culture to computer-mediated forms of communication, manipulation, production, storage, and distribution. Secondly, it has affected all older types of media, such as text, still and moving images, sound, and spatial constructions. Indeed, recent evidence suggests that the impact technologies of computation have already had on different societies and cultures is of major historical importance. Even now, they keep influencing the ways we learn, communicate, create, and simply function. There is little doubt that the process of production, storage and transfer of our cultural heritage has become more technologically sophisticated. One question that needs to be asked, however, is whether this sophistication might also negatively affect artistic creative endeavours, hiding them behind technical specifications and, consequently, making them more difficult to perceive and understand. Digital technologies have penetrated our everyday life so naturally that they have passed unnoticed, when such relatively new innovations in direct communication as, for example, web-cameras, picture and video messaging, became an inseparable part of it. Ironically, however, it is only recently that

researchers have appreciated the impact of these technologies on our culture, art, and society as a whole.

In order to understand how multimedia and digital technologies became so dominant, it is necessary to look back at the ways the older media refashioned and extended earlier ones, which were all embedded in material and social environments. The term *remediation* is used here to describe the convergence of different types of media, the absorption of one medium by another; and also to explain the assimilation of new knowledge delivered and experiences encouraged by new technological means. Coming together, each of these technologies is immersed in the others, in a way that minimizes the discontinuities between them. However, this does not mean that the older medium is entirely effaced. On the contrary, the new medium is still dependent on the older one in various ways, which from time to time are not acknowledged. For instance, the genre of computer games remediates cinema; numerous web sites remediate the monitoring function of broadcast television; and, eventually, virtual reality supposedly ends the sequence by fulfilling the promise of ultimate immediacy (Botler and Grusin, 1999, pp. 6-11, 59-60). There are little doubts that the emergence of cyberspace, as a digital network, remediates the electric communication means of the past 150 years, such as the telegraph and the telephone as VR. Botler and Grusin (1999) further argue that it refashions the visual spaces of painting, film, and television; and, additionally, such social and historical places, as cities and parks and such *non-places*, as theme parks and shopping malls. Despite remediation, the aforementioned media organically coexist and evolve together, as well as contribute and relate to each other's content. Each of these technologies is a hybrid of technical, social, and economic practices and offers its own path to



*immediacy*, with an ability to converge and create something new. At the present level of technological development, the telephone offers the immediacy of the voice, the television promises the immediacy through its real-time monitoring of the world, and, eventually, the computer facilitates the immediacy that comes through the synthesis of 3D-graphics, programming, and interactivity, that television is not able to match. Here, immediacy is referred to as transparency, where the medium is virtually absent. It can be described as ‘the notion that a medium could erase itself and leave the viewer in the presence of the objects represented, so that he could know the object directly ’ (Botler and Grusin, 1999, p.70). This study points out that this kind of technological transparency has not yet been reached, and one might also argue, as to whether there is an overall need to achieve it.

In the context of this thesis, the issue of immediacy is very important, but also quite controversial. Indeed, it is often desirable to have a transparent medium in front of, or even around us to enjoy fully, for example, a virtual performance or art exhibition, or, in other words, look at the show through the medium, in contrast to looking at the medium, in order to see a show. On the other hand, however, the most recent tendencies in mobile digital technologies illustrate the clear shift towards numerous display and screen devices, miniaturized and oversized, which we encounter on a daily basis. Therefore, this study suggests that it is quite unlikely that a new generation of technology users surrounded by various hi-tech frames from the early years of their lives would perceive any of those as a medium between them and a virtual object or performance. There is little doubt that computer language will be changing constantly, in contrast to the printed media and cinematography, which have already achieved stability in their forms,

due to the material investments in the methods of their production and distribution. Digital evolution, in its turn, is a process that produces new computer applications almost on an everyday basis. This could mean that the issue of immediacy will no longer be a problem in the future. Nevertheless, contemporary creative practitioners need to be very much aware of the technology they employ for producing artworks, in order to control the medium or, in many cases, create realistic designs which can actually be accomplished.

Nicholas Negroponte, in his 1995 book *Being Digital* defined new heavily computerized reality, as the post-information age, which is about to begin, or, one might argue, has already begun. He described future computers as machines with the ability to recognize human speech and even track eye movements, in order to respond to the users' needs and promote face-to-face interaction. Twelve years later this no longer seems impossible and contemporary users are able, at least partly, to communicate with a computer *beyond arm's length*. There is no doubt that the Internet, as a new, global, social fabric, has already changed our societal life, and indeed the very way we learn, behave, and even think. There are also many other innovative technological transformations, for example, conversational computer interfaces, which, as some researchers believe, will be widespread in the near future. This kind of responsiveness would allow participants to communicate through the use of an intuitive combination of multimodal input, identifying certain actions, and, eventually, creating consequent interaction inferences (Billinghurst and Savage-Carmona, 1996, p.168). Another prediction for the next level of digital evolution is embodied computing technologies. The majority of IT scientists (e.g. Abowd and Mynatt, 2000, Cheok *et al.*, 2002) argue that the next generation of computers will be embodied devices, which should involve elements

of ubiquitous, tangible, and social computing. The main characteristic of ubiquitous computing is that it provides advantages for creating a novel social space by offering technology that is embedded in the natural human environment and that responds to people's needs and actions in a contextual manner. Tangible computing, on the other hand, directly links the digital and physical spaces enabling the employment of the physical and tactile skills we are intimately familiar with. In other words, it would empower natural physical interaction and collaboration between participants. Ultimately, the benefit of social computing is in the incorporation of new technologies for human interaction 'that does not follow formal theoretical abstracts or procedures, but are improvised naturally in real-time' (Cheok *et al.*, 2002, p. 60). Certainly, there are many possible ways of employing these innovative technological devices – both wearable and embodied. Here, however, I focus on applications that could be used for experiencing, creating or learning about theatre.

There are various digital guidance tools that could be used for navigation between numerous historical performance venues in outdoor areas. A good example here would be the European Commission (EC) funded, Augmented Reality-based Cultural Heritage On-site Guide or, in other words, the ARCHEOGUIDE project, which offered a new approach to accessing information at multi-staged, open-air cultural sites in a user-friendly and compelling way. This was achieved through the development of a unique system based on advanced IT, including multi-modal interaction techniques, augmented reality applications, and 3D-visualization technology. Using Head-Mounted Displays and earphones, together with mobile computing units, ARCHEOGUIDE users were able to obtain various historical facts – textual and visual – relevant to the actual site



information, and also to receive further instructions, explaining how to reach other locations and stages. One of the crucial outcomes of this project was that all actions required from participants inevitably lead to their physical involvement; the opposite to a passive observation of another cultural heritage site.

Furthermore, it is necessary to mention such advanced technological applications that have already been used in the areas of education, training, and sports, as motion capture technology. Additionally, this technology has great potential for further development in the movie industry and cultural and theatrical events. It emerges as a three-dimensional representation of recorded movements by a performer achieved through special sensors which are fitted to a human body (or suit) in a way that allows their signals to be tracked in space and time by an array of cameras. All digital information is transmitted and consolidated into data files in a central workstation and then transferred to a computer, where they can be merged, connected, re-sequenced and mapped onto other anatomies in animation software such as, for example, *Character Studio* (Birringer, 1999). Undoubtedly, these technological innovations are quite interesting and challenging for creative practitioners, including theatre-makers; however, the question may arise as to whether this type of environment is a thoroughly designed theatrical space or a complicated computer game with humans, or rather physically involved digital puppets?

It is quite obvious that multimedia, virtual reality, 3D visualization and other digital technologies are here to stay. The only matter of concern that should be raised and carefully considered here is how to achieve the balance between technology, creativity and culture. Unfortunately, there is no definite answer to this question, thus every creative practitioner who is involved in the process of

producing, storing and transferring cultural values must seek his/her own balance. Some of the aforementioned technologies are currently used in some dance, acting and pilot educational experiments that are running in various research centers and HE institutions around the globe (e.g. the Institute for the Explorations of Virtual Realities at the University of Kansas, the King's Visualization Lab at the King's College London). I will provide more detailed description of some of the projects relevant to this study in Chapter Three of the thesis.

### **1.3 A Virtual Space of Theatre: Creation and Perception**

'When new plays set out to imitate reality, we are more conscious of what is imitative than what is  
real...'  
(Brook, 1968, p. 39)

One of the main principles of theatre-making is to reproduce creatively the core events of contemporary life and put them into motion on stage. The audience's understanding of these theatrical interpretations totally depends on the representation of social reality, within which every spectator is 'positioned to enact, and to experience effectively, aspects of that reality' (Guiraud, 1988, p. 30). The endemic presence of digital technology is responsible for numerous changes in the processes of theatre creation and perception. The use of multimedia applications in stage-performances enables contemporary audiences to interact with the world of theatre in a way which is compatible with our fast-moving and highly technology-oriented culture. However, there is nothing new in it. Of particular interest for this study is how theatre was challenged by technological innovations throughout modern and post-modern epochs of the twentieth century. Very often, 'grand' set designs of that time involved heavy and very sophisticated machinery, which was used for various types of theatre but especially for opera

and more recent musical performances in different countries. A good example here is a massive production of *The Miracle*<sup>1</sup> by American set designer Norman Bel Geddes, which he designed for Max Reinhardt in 1924. For this performance Bel Geddes simply transformed the horizontal stage and balconies of the Century Theatre in New York into a Gothic cathedral, making the whole theatre space a stage:

I wanted the members of the audience to feel that they were in a church, at a service and not a show. They must enter a dimly lighted church as they would have done to see *The Miracle* in the twelfth century.

(Geddes, 1960, p.274)

This kind of approach to scenography was quite common amongst modernist theatre designers in Europe and the United States in the early twentieth century.

Indeed, performing arts combine different media elements, but also support interaction and connection between the audience and the stage, in order to provide constant feedback. Nowadays, all these issues are strongly relevant to contemporary electronic culture and, in particular, digital media. One might argue that the art of the theatre has many similarities to the phenomenon of virtual reality. In an historical sense, artists have always used impressive immersion tricks, such as physical surroundings with fake perspective, panoramic views, or fresco images, to immerse the audience in illusory reality. Grau (2003) indicates that all these attempts received further development with the appearance of cinematography, computer technology and later virtual reality. Gere (2002) further argues that multimedia proved to have a strong connection with, for

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<sup>1</sup> The first production of *The Miracle* was staged by Max Reinhardt at the Olympia Exhibition Hall in London in January 1911 (see Esslin, 1977, p. 12).



example, the great cathedrals of Europe, the Dionysian rituals in Greek tragedy, Richard Wagner's concept of the total artwork, the *Gesamtkunstwerk*, in addition to a variety of other practices involving a combination of sounds, words and images. Richard Wagner, for example, in 1849 defined drama as the ideal medium, which united all separate branches of art including music, architecture, painting, poetry, dance and embraced them in the *collective art-work* and the *synthesis of the arts* – the *Gesamtkunstwerk*. He believed that this total art work, this fusion of arts would attain *new poetic heights* in theatre space. Packer and Jordan (2001, p. xviii) describe Wagner's ideas as 'one of the first attempts in modern art to establish a practical theoretical system for the comprehensive integration of the arts through the "totalizing", synthesizing, effect of music drama – the unification of music, song, dance, poetry, visual arts, and stagecraft.' The main feature of this system could also be described as immersion, experienced by the audience during theatrical performance, when spectators literally lose themselves in the veracity of the drama.

Similar to Wagner's approach to the theatre with its scenery, lighting and acoustical design, Laszlo Moholy-Nagy's idea of the *Theatre of Totality* foreshadowed the experience of virtual environments. It challenged the passivity of the relationship between the audience and stage performance by using innovative techniques for diluting the traditional *fourth wall* – in theatre terminology, the invisible frontier that divides the stage and the audience into two clearly perceptible parts – within the theatrical environment. His interpretation of Wagner's concept of *total theatre* included the reduction of the importance of the written word and the presence of the actor. Instead he developed the idea of the *Mechanized Eccentric*, which brought numerous technical devices into every

aspect of the stage performance. Moholy-Nagy's machinery would travel across a multi-planed stage and would literally immerse the audience in the action. Everything and everybody – text, actors, stage design, lighting, music, and visual composition – were equal in the theatrical space (in Packer and Jordan, 2001, pp. 16-26).

It is suggested above that the modernist movement was mostly about disillusionment with conventional expectations, interest in new technologies, freedom of expression and radical visions. The rejection of tradition and attempts to undermine conventional thinking were probably the most controversial aspects of the movement. Ironically, however, one might argue that the rejection of tradition had become a tradition in its own right, which meantime has been interpreted by many researchers as the beginning of the post-modern era. However, there is much overlap between the two. Postmodernism, in its turn, brought forward many assumptions, one of which was that authenticity is no longer verifiable, and that something new can only be created through mixing existing art forms, styles, technology and media. The capabilities of new technologies also enabled theatre-makers to concentrate more on the emotional aspects of the theatrical experience. 'The ability of the computerized theatre, as a newly endowed *Gesamtkunstwerk*, to operate with such intensity on this emotional level has generated a new, popular and strikingly populist form,' – a contemporary musical theatre (Baugh, 2005, p. 210).

According to Causey (1999, p. 383), despite the fact that theatrical performance 'has been extended, challenged and reconfigured by way of its position in the space of technology', at present, it is obvious that 'there is nothing in cyberspace and the screened technologies of the virtual that has not been

already performed on the stage.’ Although these courageous statements might appear to be over ambitious, theatrical performance and VR experience indeed have a lot in common. This study is in agreement with Reaney (2000, p.1), who points out that they are both ‘time based, existing only during that time that the human participants are engaged with them. Both rely on the creation of a fictive universe designed to entertain, inform, and enlighten.’ The theatrical environment is already a virtual space. It is a medium, which extends beyond the edge of traditional media, such as film, television, radio, print and computer technologies. Furthermore, VR simulations possess such theatrical characteristics as passing from one virtual space to another, which is analogous with the change of scenes; linking many spaces together to form a larger meta-space; suggesting varying degrees of visual and acoustic transparency; and explicitly or implicitly representing boundaries to the audience. All these features could be further intensified by various digital means, which offer an unlimited capacity for creating complex images and sounds that, if designed with care, are able to enrich the multi-textual nature of theatre. However, the question whether these sophisticated simulations could offer something new (e.g. a new form of theatre) still remains open for discussion.

Theatre has proven to be slow in implementing new production methods and techniques, mostly due to lack of appropriate financial resources. Nonetheless, it should be acknowledged that a new type of a theatre-maker and a creative practitioner has emerged. According to Grau (2003, p. 3), these new artists not only research such innovative techniques as interface design, virtual interaction and their freshly emerged forms, but also act as artists and as scientists at the same time, in order to contribute to the development of the medium in key



areas. They are inventive, imaginative, and not restrained by technological limits; on the contrary, it is their responsibility to push the boundaries of technology itself. This study argues that there is a strong polemical thrust to this statement. For some artists, the sophisticated communicative and creative possibilities, provided by modern digital technologies still look impersonal, thus for many years a number of them refused to acknowledge that computers can resolve many difficulties of living in a global community. The motives against using digital technology for art-creation are numerous, ranging from the inability of computers to generate *true color*, to a general perception that their extensive use poses a threat to artistic creativity, in that machines are potentially taking over a thinking process. The logic here is partly flawed, because, for example, it is a fact that human beings can distinguish only a few million colors. Using twenty-four binary digits (bits) – the smallest unit of information – on a machine means that about 16 million unique colors can be represented on a screen, which is enough to accurately visualize and perceive any color image. On the other hand, however, a number of designers can be contrary users of computer programs, in order to get unpredictable software responses, which in fact, can be considered as allowing a computer to be responsible for the process of creation (for a full discussion, see Chapter Three). It would seem that often the true reason for this skepticism about computers penetrating the art world is our technical underdevelopment and lack of specialized knowledge and experience.

Nevertheless, an increasing number of productions are getting ‘immersed’ in cyberspace, using the opportunity to reconfigure the meanings of art, theatre and technology; their aesthetics and ethics, societal beliefs, psychology; and ultimately, by using VR devices, the artist-audience relationship. The division

between an actor and a spectator is used to separate two realities: 'the reality of the performance artefact, with its aesthetically contrived space and time, and the reality of so-called everyday activity, where space and time obey other sets of codes' (Benford *et al.*, 1999, p. 23). Osberg (1997, p. 10) suggests that nowadays, virtual space acts as an alternate *reality*, based on *perception*, instead of the traditionally accepted statement that *perception* is grounded on *reality*:

Since our virtual experiences are entirely within the realm of perception, instead of grounded in our physical world, we are no longer fettered by physical constraints, or our traditional social constructs of right and wrong.

These issues are very important to enable a precise understanding of the role new technologies play in contemporary society. They will therefore be further discussed in Chapter Two.

In the beginning of the twentieth century the rapid development of recorded media was considered a threat to live theatrical performance. Since then, however, many sophisticated special effects based on current technological breakthroughs were introduced to the theatre, in order to enhance the element of 'spectacle' in various theatrical productions. Some of the technological innovations demanded specific modes of interaction and, as a result, the whole structure of performance arts began to change. *Interactivity* was born, as the most inclusive term to describe the most prominent type of art in the digital age.

#### 1.4 Interactivity as a Style of Theatrical Existence

'Interactivity, which the Duden calls a "dialogue between a computer and its user", begins where interaction ends.'

(Wand, 2002 p. 165)

Willemsen (2002, p. 14) defines interactivity as ‘a feature of any representational media, from religious rituals to painting, novels and cinema’; from classical Chinese poetry to the ‘call-and-response structures of gospel and jazz music’, to Surrealism and to just ‘about all forms of commercial verbal and imaged discourses in which feedback mechanisms have played a determining role for at least a century’. Although computer-based media is interactive by definition, it does not mean that interactivity is unique only to the technologies of computation. This is simply a new form of communication, which emerged because of another shift in how we perceive the world. For example, the interactive works of art absorb the operational qualities of a digital medium, in order to create spaces of experience that can be modified by the actions of the users. Furthermore, in the interactive theatre, a live action ultimately renders the storyline non-linear, so that the exact development of a play can no longer be predicted. It means that the audience gains a first-person experience, where the spectators are transformed into active participants, interacting with play-characters on different levels within a multiple-act story.

According to Birringer (1999), there are different modes of interaction and at least four of them in digital art and theatre. The first model is a *touch-screen* interactivity that is widely presented in inter-media exhibitions and video installations with Internet access. The second one is interactivity that extends deeper into cyberspace, implying distance and spatial separation; it involves reciprocity and feedback, and can be used in broadcast media. The third model represents a conceptual structure of the meeting points and conduits of interactive levels and suggests that interactive digital art is not subject to a particular technological mode, but the intermixing of analog and telematic (i.e. combination



of computers and telecommunications) media. For example, some interactive performances are connected via the WWW or satellite, and staged in real time to audiences at several locations. Simultaneously, other artists connected via modem and the Internet can be invited for input participation. This means that externally transmitted video images, sound-samples, voices and texts can be instantaneously integrated and layered onto the video projection and sound mix in the real space. Additionally, the real time performance can also be recorded with digital cameras and projected into the virtual space that is created by the WWW. Finally, the fourth model of interaction exists only inside the immersive virtual environments. Certainly, the perspective to be fully immersed in virtual space may fascinate many theatre researchers and modernizers; however, at the present stage of VR development a total transfer of users' senses from the real world into a virtual space cannot be tested without the existing restrictions of wearable devices. This implies that body movements have to be recorded inside a computer, which due to current limitations in the computer processing capacities, significantly reduces the number of participants who can be transferred simultaneously into virtual performances in cyberspace.

Interactivity, as a new form of theatre creation and perception, also empowers set designers to create productions that are rich in information, imagery and storylines. These designs extend beyond the visual to the tactile; rapidly change the time and the place in the course of a performance with little regards for physical limitations (Cheok *et al.*, 2002). The main idea here is to make the audience responsible for binding the plot of the performance together, which is sometimes difficult to achieve when conventional scenographic techniques are employed. The process of designing can be defined as a creative exploration of

theatrical space in conjunction with text, specially devised for a future performance. Commonly, designers translate their artistic intentions into technical instructions; however, the employment of digital space as a design-tool increases the flexibility of visual research and combines it with 3D-modeling, *intelligent* lighting and movement applications. Furthermore, it invites creative practitioners to play and experiment, facilitating unconventional ideas and ultimately the construction of unique theatrical sets. New virtual staging techniques can enhance, or one might argue even replace, traditional theatre design with flexible, computer-generated sets that, unlike video or animation, are not pre-recorded and can be manipulated during a real-time performance. Digital scenery is perfectly able to reflect the development of the plot, it is unique to every theatre piece, and it is portable and adaptable to almost any theatrical space. Similar to most designs, if overused, it may cause the storyline to disappear ‘behind the decorations’, ultimately leading to performances that lack artistic depth. Virtual environments, however, are not limited to the physical boundaries of real space – thus, some researchers argue, the introduction of digital scenery into the theatrical world ‘has significantly accelerated the movement towards the artificial animation of onstage actors, moving it closer to the movie screen and the theme park ride’ (Carson, 1999, pp. 433-441).

Every theatre performance has unique moments of improvisation on stage and unpredictable reactions from the audience. If a theatrical event takes place in non-immersive cyberspace, the scenery appears as the interface that a contemporary audience could have on their computer screen. It also provides the feeling of distance, which can be also classified as the *fourth wall*, implying that, at least in this regard, the relationship between the virtual actors and the audience

is guaranteed (Wunderer, 2002, p. 203). If spectators are *virtual* (e.g. represented by the avatars), they might greatly affect the flow of the performance. A good example here is the Façade Project<sup>2</sup> – a one-act interactive drama, – which was released in July 2005 and ‘provides a novel architecture for supporting emotional, interactive character behavior and drama-managed plot.’

Despite the fact that the cyber-audience is able to respond by using multimedia tools, such as web-cameras and microphones to broadcast its reaction, this process can quite possibly get out of control, especially if the performance is live. On the other hand, however, this innovative feedback mechanism is not necessarily a negative experience; it could also provide new insights into audience-performance interaction. This opportunity for unlimited collaboration between participants and VR worlds should be used with caution, because it may provoke a situation, where the important narrative events will never be experienced. Some researchers believe (e.g. Steiner and Tomkins, 2004, p. 1) that by reducing interactivity in multimedia systems, the author of a narrative obtains much more control over the users’ experience of key events in virtual environments. On the other hand, however, such constrained interactivity may reduce the feeling of the spectators’ immersion and engagement with the performance. Thus spectator-to-VR interaction should be carefully balanced.

There are many theories about how new technologies of computation could potentially enhance existing theatrical techniques, some of which have been

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<sup>2</sup> You, the player, using your own name and gender, play the character of a longtime friend of Grace and Trip, an attractive and materially successful couple in their early thirties. During an evening get-together at their apartment that quickly turns ugly, you become entangled in the high-conflict dissolution of Grace and Trip’s marriage. No one is safe as the accusations fly, sides are taken and irreversible decisions are forced to be made. By the end of this intense one-act play you will have changed the course of Grace and Trip’s lives – motivating you to re-play the drama to find out how your interaction could make things turn out differently the next time.

(The Façade Project. Available: <http://www.interactivestory.net/#facade>)



more or less successfully accomplished on stage. Ironically, however, there are not so many ideas about how digital media could influence the emergence of, for example, new forms of theatre. Usually, researchers are much more interested in speculating on the methods of delivering theatrical experience. For example, Zellner (1999, p. 27) states that new digital technologies gave birth to two innovative types of theatrical space – the *Enhanced Theatre* and the *Virtual Theatre*. The *Enhanced Theatre* is situated in a physical environment with virtual scenery inhabited by live and virtual actors. The *Virtual Theatre*, on the other hand, introduces a virtual performance that a single audience member can experience, while wearing a Head Mounted Display. This type of theatrical space offers its spectators a three-dimensional performance that can be experienced in any location with computer input. Here, it is necessary to point out that this method of delivery has the potential to completely change the medium itself. This has already happened when theatre on television attempted to bring a theatrical experience for mass audiences, sitting in front of their TV screens at home. It can be barely defined as a successful invention – theatre on television loses its liveliness, becomes absorbed by ‘the logistics of television coverage’ (Ridgman, 1998, p. 6), and becomes television. Thus, this study suggests there are two possible outcomes of the VR home-theatre concept: it could be either a new theatrical form, or a new type of interactive computer game with live characters involved. At present, however, this question cannot be answered.

Nowadays, theatre researchers and computer scientists conduct numerous experiments with live web-casting, in order to discover how the Internet could be used to share live theatre performances. Furthermore, they are trying to create virtual playing spaces that will be inhabited by avatars or virtual characters

controlled by participants from remote locations for purposes of interaction. These technology-oriented projects have their main focus on research and education. However, there is no doubt that, in the near future, these experiments will lead to the professional and more successful staging of live theatre shows over the web. Evidently, computer technologies offer a vast range of powerful tools for experiencing theatre space, as well as for creating it. However, they are not able to solve every single technical problem that could potentially arise in a theatrical space. As a matter of fact, they could even cause a failure to perform, if the computerized system collapses. Contemporary musical theatre is a good example in this regard – here, almost all scenic elements are run by computers, and the success of the whole performance depends on their smooth operation.

### 1.5 Concluding Remarks

The act of *remediation* in modern digital culture is responsible for the absorption of the older medium by the new one. Digital media simply follows the tradition of photography, film and television, which have been constructed by culture to embody all emerging distinctions, and make them a part of reality. There are numerous advantages in employing new media technologies in the art and theatre world. However, such side-effects of the new digital era as the invasion of privacy, the abuse of intellectual property, digital vandalism, data theft and even possible *performance hackers*, who might attempt to interfere or alter the real-time online theatrical performances, should also be borne in mind.

It is not surprising that the relationship between the new media and the theatre was and is constantly evolving and considerably influencing the audiences' experience of the theatrical world. Theatre has always played a key-role in

shaping and re-shaping trends in popular culture. There is no doubt that it will continue to feel the impact of the novel role-changes in the relationship between the spectator, the author, the performance and new technologies that, nowadays, are seen as an integral part of theatrical space. The audience members are no longer reduced to passive viewing – they are an essential part of a theatrical performance and may even influence the sequence of the plot. Interestingly, however, theatre somehow fails to fully exploit a wide range of recent technological inventions available for stage implementation and also for enhancing teaching strategies in theatre education. Unfortunately, the reason here is not only insufficient funding, but also lack of motivation, an issue that will be discussed further in the following chapters. Thus theatrical space is a field under investigation, and the question whether the use of digital technologies for theatre-making is intensifying theatrical experience or eliminating its very foundations is still very much alive.

Cyberspace is emerging as an unlimited space, where information can be saved and communication facilitated. It is constantly expanding and also correlates with physical reality – gradually becoming a part of it. Virtual environments are not necessarily simply another space for artists to express themselves in the same way as they used to do. The cyber-world offers a number of new opportunities to enhance, as well as change the processes of art and theatre-making. Nevertheless, it remains quite arguable whether computer technology can enhance ‘real’ creativity, as opposed to *technicality*, although, one might argue, that technicality could also be creative. Obviously, the technological capacity of computers is not unlimited and should be carefully balanced when used for the creation of an artwork. The question where technology should be



involved and where not, must be answered by each individual artist. Additionally, there is a risk that creative practitioners no longer concentrate on art *per se*, but get absorbed by the fascination of technological innovations. Therefore, it is necessary for them to understand the intellectual and philosophical implications of their work. The use of new technologies in theatre creates a lot of scope for desirable attempts to break with conventions, but it has to be done with care – otherwise it will merely be an end in itself. The most important aspect of creativity in technology-based art is keeping the focus on art, not on technology.

In the next chapter, I will further investigate new media technologies, with particular focus on defining virtual reality and its applications, and outlining its cultural use in contemporary society. Furthermore, I will discuss some of the important devices that are employed for the creation and perception of VR performances, and also concentrate on the development of the fundamental principles of design as one of the central activities in the process of theatre-making.

## **CHAPTER TWO: CULTURAL USE OF CYBERSPACE – PARADIGMS OF DIGITAL REALITY**

**‘Art, or the graphic translation of a culture, is shaped by the way space is perceived.’  
(McLuhan and Fiore, 1967, p. 56)**

Society is facing a future in which technologies of computation will play an increasingly important role. In recent years, digital representation has become mainstream. It would be difficult, if not impossible, to identify precisely all the complex facets of this development, but all the available evidence suggests that computers are here to stay. They are diffusing into almost all other technologies employed in art, science and education, offering new opportunities to create, experiment, and learn. Nowadays, a succession of technological advancement has made it possible to express ideas, which used to be conceived as words, numbers, symbols, shapes, pictures, or sounds [and which required a person to interpret them], in patterns that can be stored on digital media. This information can be easily, cheaply and rapidly reproduced, disseminated, and also manipulated by both machines and people. Another aspect of this rapid technological development is its influence on people’s creativity and imagination. People are designing ways to socialize in new cities, communities, and through new networks. They create novel modes to spread knowledge and information, resulting, as Stolterman and Schuler (2000) argue, in a world-wide and rapid distribution of ideological, cultural and social messages. However, this development does not imply that society necessarily foresaw all the consequences of accepting these technologies. Undoubtedly, new media have already become an

integral part of our culture; however, the ethical, aesthetical, psychological and overall societal implications of this recent marriage remain to be explored.

This chapter is wide-ranging. It offers a multidisciplinary approach to defining and critically discussing the phenomenon of virtual reality and its applications. After reviewing the existing literature, I found that there is a need to provide the reader with a thorough analysis of the role VR plays, especially within the fields of knowledge, which are strongly connected to the world of theatre. In this chapter, numerous factors that facilitated the paradigm shifts that have recently occurred in different areas, including theatre education and practice, will be addressed and analyzed. I will critically discuss *digitality* and the notion of *uniqueness* in a computer-generated world. I will define *immersive virtual reality* and explore different levels of immersion within VR environments, in order to outline the consequences of this new simulated experience for theatre audiences. Furthermore, I will describe mixed and augmented reality applications and analyze a wide range of software and hardware, used to enable participant-cyberspace interaction, with special emphasis on their relevance to the theatre. Here, I argue that despite the common perception of VR as a tool or an environment, in the context of this thesis, it is also presented and discussed as an art form, performance and educational platform in its own right. In order to fully illustrate the impact technologies of computation have on contemporary society, culture, art, theatre, education, and design, this chapter is divided into nine subsections (paradigms), where I will analyze all the influences, outline existing research tendencies, and also consider possible implications that digital technologies might have on academic and creative practices. Each paradigm will



illustrate how important technologies of computation have become within numerous disciplines, and will examine their relevance to the theatre.

My strong belief is that this chapter will contribute significantly to a broader understanding of the ‘realities’ of digital culture.

## 2.1 Real or Virtual? The ‘Realism’ of Digital Reality

Chapter One indicated that VR is generally considered as a computer simulation of a real or imaginary system that enables users to perform real-time operations in virtual environments. However, according to Jacobson (1992), above all, it is a part of global information and communication infrastructure – so-called cyberspace. The term *virtual reality* is one of the most problematic in any discussion of contemporary digital art and interactive theatre. In the context of this chapter, there is a need to outline and discuss definitions of virtual environments most relevant to this research. Rush (1999), for example, understands virtual reality as one of the more mystifying outgrowths of digital technology, which is not only a mere translation of data into life-size images that mimic reality, but also is its own reality. Indeed, digital techniques have made it possible to build upon the ability, artificially or virtually, to construct realistic environments. A common misconception about the term *virtual* is that it means *not real*, or that it refers to something that exists in our imagination only. Certainly, virtual images are simulations that represent ideal or constructed rather than actual conditions; however, they are true in VR. Pierre Levy characterizes the *virtual* as being opposed to the *actual* – not to the *real*. He emphasizes that virtual objects have a real, or in other words, material existence, however, they differ in that their full potential has not yet been realized (in Packer and Jordan, 2001, pp. 335-344). ‘What is real?’ asked the character of Morpheus in the

blockbuster *The Matrix*. The simple answer would be anything we can explore through our senses. However, remembering a simple experiment with a pencil and a glass of water during one of my physics lessons at school, I must disagree with the statement above. If you put a whole pencil in a transparent glass filled with water, it will appear to be broken, so it is obvious that our senses can deceive us and something that appears *real* can be *unreal* at the same time. This is obviously an ‘old’ discovery. About 55 B.C. a Roman philosopher Lucretius in his work *On the Nature of the Universe*, Book IV *Sensation and Sex* wrote:

The nature of phenomena cannot be understood by the eyes. You must not hold them responsible for this fault of the mind. ...To landsmen ignorant of the sea, ships in harbour seem to be riding crippled on the waves, with their poops broken. So much of the oars as projects above the waterline is straight, and so is the upper part of the rudder. But all the submerged parts appear refracted and wrenched round in an upward direction and almost as though bent right back so as to float on the surface.

(Translated by Latham, 1951, pp. 142-144)

There is little doubt that the relationship between human beings and visual imagery is deeply grounded in the art traditions of our society, however, for the last few decades the very idea of the image was irreversibly changed by interactive media. Grau (2003) points out that VR has recently become an inseparable part of this core relationship, transforming a picture into a multi-sensory interactive space of experience with a time frame. Indeed, a VR panoramic view with its *sensorimotor* exploration of an image space causes the effect of a ‘living’ and evolving environment, where the parameters of time can be deliberately modified. There is also a range of new options such as *mixed realities*, where images of the real world are blended with artificial images in a

way that makes it very difficult, if not impossible, to distinguish between them. Therefore, it is not surprising that all these innovative applications raise an intriguing question about (artistic) originality or *uniqueness*. Digital images are stored in the form of binary codes, and their value is derived in part by their capacity to be easily accessed, downloaded, stored, manipulated, and reproduced. For computer-generated environments the idea of the difference between a copy and an original is nonexistent or, to be more precise, the notion of a unique image is rendered obsolete in digital worlds. Obviously, this is not the first ever attempt to 'fake' realism. The myth of photographic truth is one of these examples. In the past, the photo-camera was perceived as a visual medium, which was more accurate in recording reality than any of the other then available means, such as painting, drawing or sculpture. However, even in the early days, photographic techniques were employed to manipulate, more or less successfully, humans' perceptions of real events and environments. This was achieved through retouching, airbrushing, cut-and-pasting, and also re-photographing already existing photo-images. At the beginning, this manipulation of reality was very time-consuming, expensive and, furthermore, required a highly-skilled specialist to accomplish the task. Nowadays, every single desktop can function as publishing equipment, which can be used for scanning, editing and manipulating images. These technical specifications of a computer gave birth to a misapprehension of the modes used for the creation of virtual environments and imagery. One might believe that actual or representational images are produced through analog technologies; but virtual images, on the other hand, are only created through digital means and are specific to their era. In reality, however, virtual images are both analog and digital. They break with the convention of



representing what is seen. A virtual image of a human body, for example, may represent no actual body in particular, but may be based on a composite or simulation of human bodies drawn from various sources.

Virtual reality is able to incorporate computer imaging, sound and sensory systems, in order to put the participants in a direct feedback loop with the technology itself and the world it simulates. Rather than offering an environment to simply view and hear, like in traditional theatre or cinema space, VR attempts to create an experience, in which users feel as if they are physically involved in the world represented on all sensory levels. There are various external hardware and visualization systems that make interaction with virtual environments possible and achieve different levels of *immersion*. Virtual reality offers a three-dimensional experience where, with the help of various devices, such as head-mounted displays, data gloves, or body suits, users experience a VR world that appears to respond to the participants' actions (Rush, 1999). Immersion within virtual environments acts as a replacement of the passive aspect of observing a computer monitor. It exists in parallel to our own reality and can be defined as augmented, partially immersive and fully immersive. VR systems enable their users to experience computer simulations of digital spaces that either have some correlation with the real world or which are completely imaginary. These environments are interactive, navigable in real time, and are not bound by any physical limitations. The decision process, in which participants distinguish between real, virtual, and imagined events is called *virtual reality monitoring* (Hoffman *et al.*, 2001, p. 565); where the quality of the involvement very much depends on to what extent the participants apply a willing suspension of disbelief.

It is obvious that a pure preoccupation with VR worlds, without attempting to explore new ways of employing this technology for creating something new, appears rather paradoxical. Therefore, at present, there are a number of online galleries, which offer their viewers a closer look at the images displayed in the actual exhibition space, using their home computers. This study believes that such a novel method of information transfer also has great potential for the theatre in, for example, delivering the previews of future performances and venues.

## 2.2 The Ethical Paradigm

'Ethics is in origin the art of recommending to others the sacrifices required for cooperation with oneself.'

Bertrand Russell (in Pigden, 1999, p. 109)

Nowadays, the process of digitization creates new dimensions of perception, which in turn lead to some ethical considerations that have never previously occurred in our society. Obviously, virtual reality is a completely new environment, where its users can potentially find themselves under circumstances they have never encountered before. However, one might argue that the morality of cyberspace is based on the same codes of ethics, and that innovative VR practices only slightly transform the concept of truth and reality. This transformation only happens because of the roles which are allocated or even forced on the participants, while interacting with or within virtual spaces.

VR puts into question our traditional, western views of cosmology, epistemology and metaphysics by providing a perceptual construct of an alternate reality. This perceptual state is fundamentally different from our known, physical realm and our behaviors therein. Without this physical 'grounding' point from which to speak, it is difficult (or may not even be applicable or possible) to establish a

*singular*, rule-based way of being, or of meaning-making, or of clearly establishing 'right' from 'wrong'.

(Osberg, 1997, pp. 9-10)

All ethical norms are only relevant in connection with a belief system that indicates existing and non-existing things to assist a person in evaluating *truth* or *untruth*. Being *true* is generally referred to as giving the true facts about something, as opposed to being imagined or guessed. Although VR environments bear a notion of reality, they are better described as an *experience*, not a *place*. Despite the fact that some scholars (e.g. Baudrillard, 1988, p. 16) have argued that in virtual space 'we no longer exist as playwrights or actors but as terminals of multiple networks'; this study is in agreement with Giannachi's (2004, p. 124) statement that *virtual* is 'the main theatre of the real – the place from where the real can be viewed, a space for critique, art and politics.'

The majority of ongoing experiments with VR in the field of computer sciences are concerned with the practice of imitating the action radius and the sensory experience of real environments in virtual worlds. For example, Wand (2002) identifies two different approaches to achieve a maximum 'reality-effect' in cyberspace. The first approach is the implementation of accessory devices and specialized applications, in order to improve the simulation of reality and to enhance the *sensuality* of computers (e.g. the use of data gloves and virtual reality helmets fitted within a stereo three dimensional spectacle). The second way is the reconstruction of the real conditions in virtual space, inhabited by avatars or representatives, who can be individually operated by a number of participants (e.g. the Second Life – <http://secondlife.com> – a 3D virtual community, which is built and owned by its 1,800,000 residents). There is little doubt that these practices successfully generate a genuine realm of possibilities and an



accompanying range of options in cyberspace. However, VR desperately demands a plot motif to come into existence, in order to evoke a necessity to act. This need leads to various modes of behaviour and patterns of action that dramatically affect the truly autonomous interactivity of cyberspace. Some of them, however, could potentially disappear once the issues of authorship, regulations and the contextual environments come into existence. VR is undoubtedly able to simulate reality simultaneously being different from it; thus it could represent 'a perfect rehearsal space' (Giannachi, 2004, p. 151).

According to Weibel (2002), contemporary visual culture attempts to liberate itself from the technical and material restrictions of imaging technology, as well as from the repressive determinants of its social codes. However, this claim can be challenged on the grounds that the continuous interaction between art, science and technology is constantly causing the emergence of new cultural forms, behaviors, values, and, as a result, a new set of social rules. For example, the person in cyberspace can be considered to be in two places simultaneously or, as one might argue, somewhere in between. The Internet gambling industry in the United States of America is a good example to support the above statement. Adams *et al.* (1998) explain that in general, gambling is allowed only in some American states, while prohibited in the others. If gambling takes place online or, speaking figuratively, without geographic boundaries, the following question arises: if a gambling server set up in a state that allows this activity, but was accessed in a state that does not, which state's law should apply to prosecute an illegal gambler? There are many similar questions which are still left without definite answers, because of the obvious duality of virtual environments. At present, cyberspace is an essential component of contemporary society's self-

description and cultural changes. Therefore, in order to define the use of technology in producing contemporary culture, it is necessary to introduce a new term – *technoetic* (Jones, 2000, p. 125) – that might be the key to explaining how our perceptions and knowledge of the real and virtual worlds around us evolve.

Botler and Grusin (1999) point out a tendency to regard digital media and especially virtual reality as an extension of our societal beliefs. Indeed, they are constructed by people and thus utterly reflect human nature. However, despite the fact that cyberspace is indeed a space for ethics, this study argues that it is still uncertain how rule-and-value-systems can potentially evolve in virtual environments.

## 2.3 The Aesthetical Paradigm

‘In the long term perspective, the concept of utilizing interactivity to develop our creativity and our awareness is one of the most promising avenues that could lead to a new aesthetics of interactive computer art.’  
(Grau, 2003, p. 347)

*Aesthetics* usually refers to philosophical notions of the perception of beauty and ugliness. The question as to whether such qualities are within the object itself, or exist solely within the viewer’s mind, has been debated by numerous philosophers and artists for many centuries. The term was introduced by a German philosopher, Alexander Gottlieb Baumgarten, in about 1750, to describe the science of sensuous knowledge, the aim of which is beauty, as contrasted with logic, the aim of which is truth. Obviously, there were numerous interpretations of this word. Immanuel Kant, for example, used the term *transcendental aesthetic*, which he defined as universal and separate from judgment or subjectivity. He strongly

believed in pure beauty that cannot be found either in nature or art. However, the term was eventually established in its present sense in the 1820's by Georg Hegel in his writings on art under the title of *Aesthetik*. There he built up the concept that art is the highest beauty, which is firmly placed on the expressive artistic self:

For the beauty of art is the beauty that is born – born again, that is – of the mind; and by as much as the mind and its products are higher than nature and its appearances, by so much the beauty of art is higher than the beauty of nature.

(Hegel in Inwood, 1993, p. 4)

Indeed, aesthetics studies works of art and how they were produced and experienced. The contemporary concepts of aesthetics emphasize that the criteria of what is beautiful and what is not are simply based on taste, which is not innate but rather culturally specific.

There is little doubt that the recent expansion of cyberspace has had a significant influence on contemporary visual culture and especially on its aesthetics. One might argue that aesthetics in the new digital era is focusing on creating user-friendly software (i.e. *software aesthetics*), and designing aesthetical computer interfaces including video games, online communities and also VR simulation. In this case, all these applications should also be considered as works of art and consequently aesthetic objects. Currently, the dispute within the academic environment concerning whether virtual reality is an *object* or a *process* has generated strong polemics. Some argue that 'virtual reality is not only a medium, like television or film, but, like language, a medium that is able to reinvent itself... In it, the viewer may not only experience their own performance of the medium, but may witness the medium's capacity to perform itself' (Giannachi, 2004, p. 124). Others insist that virtual space is 'urban nomad,



software engineering, the liquid architecture of the knowledge space' (Levy, 1994, p. 338), which contributes to collaborative work-in-process. Furthermore, a small minority still believes that VR is a *finite* environment. This study argues that despite being representational, virtual reality also possesses an ability to be self-reflective and also to communicate knowledge. All these qualities are very specific to a process, rather than a restricted object.

From the 1960s onwards there have been numerous attempts, mostly made by installation and conceptual artists, to redefine traditionally defined aesthetic objects through applying various practical approaches (Manovich, 2001, p. 163). Roland Barthes in his article *From Work to Text* defined text, traditionally treated as an object, more like a *field* or an *event*, which is *radically symbolic* and lacks closure (pp. 158-159). Although this could be interpreted as an attempt to go beyond traditional aesthetic concepts, Barthes continued to treat it [text], as a self-contained structure limited in space and/or time (Manovich, 2001, p. 163). To date, this vision of any aesthetic object remains central to the field of contemporary aesthetics. This research argues that the illusionary symbiosis of spectator/participant and a work of art in cyber-world represent a progress, where the *interface*, which is the key to any VR artwork (i.e. aesthetical object), can be understood as a form of interaction, representing, in a wider sense, a specific level of *perception* in virtual space. For example, there are some similarities between interacting with VR applications and watching a theatrical performance. A performance, both real and virtual, is a process, but at the same time a self-contained object, which is different each time a theatre audience perceives/interacts with it. This can be explained by the improvisational quality of

theatrical space and also by the responsive nature of computer-generated environments.

There is little doubt that new technologies, centred upon digital micro-processing and computer programming, are transforming the nature of cultural production and perception. *The Columbia Electronic Encyclopedia* (2006) defines *perception* as mental organization and interpretation of sensory information. It is influenced by a variety of factors, such as our past experiences, motivation and emotional state, the intensity of the stimuli, and also by the effect of preceding stimulation. The components of perception are simple. The first two are a human's sensory mechanisms and the ways our brains interpret information delivered by the senses; and the second one is *meaning*. Undoubtedly, communication is an attempt to transfer meaning, to share our emotional, visual, or aural experiences with other people. New computer-generated environments create a higher level of communication and information manipulation through combining text, images, and sounds and have the potential to further enhance the process of exchanging meanings. Nevertheless, even with the emergence and rapid development of such relatively new concepts as *simulation*, *interactivity* and *immersion*, digital media maintain a sense of multiplicity or hypermediacy that indicates the presence of previous means of communication and interaction. Thus terms like *realism*, *illusionism*, *artwork* and *spectacle* are still very much alive within artistic practices (Darley, 2000).

The *artwork*, whether it is a painting, sculpture, or a performance, symbolizes a certain artistic view of reality. It has always been subject to historical change, where one form of art after obtaining the status of paradigm would be replaced by another. From the aesthetical viewpoint, the evolution of

this term is particularly interesting in the context of digital reality. All digital images, in which the *real* and the *imaginary* are non-referential, categorically differ from traditional ones with their 'fixed' materiality. However, computer-generated or modified imagery represents truth, no more and no less than any other work of art. It has already been noted that the concept of the *original*, which is common in the traditional art world, is foreign to digital space. Obviously, the system is in charge of any kind of alteration; however, it is not able to guarantee any protection from copying the original artwork. Furthermore, the software and hardware devices can also be modified, in order to create mixed realities, where it is often impossible to distinguish between the unique and a simulation. As a result, the convergence of the work of art and technology into an inseparable whole could make the artwork (as an autonomous aesthetic object) disappear as such (Grau, 2003, p. 349).

One might argue that digital aesthetics is very much in charge of the present and the future of our ethical life in contemporary society. Although virtual art is no longer exclusive, in terms of creating aesthetic models of computer-generated worlds, there are some doubts that a common consensus on cyber-aesthetics can be reached today. In 1995, Lev Manovich predicted that instead of being charged for WWW connection time, in the near future users might be asked to pay for visual aesthetics and the quality of the overall virtual experience: spatial resolution; number of colors; complexity of characters - both geometric and psychological. This is, in fact, already happening in the industry of computer games and avatar communities, where animation quality at least partly determines retail prices.



## 2.4 The Psychological Paradigm

‘All media are extensions of some human faculty—psychic or physical.’

(McLuhan and Fiore, 1967, p. 26)

There is an immense compression ratio between digital information and human experiences. Thus, from behavioral and perceptual viewpoints, psychology serves to help us in creating, experiencing and inhabiting virtual worlds. Bricken (1990c) argues that it is *the physics* of virtual reality that reflects upon the rules and constraints of computer-generated environments, and where *interaction* is natural behavior. Our dependence on the internal state is obvious. Additionally, any interpretation of virtual involvement must also consider the external context – the environment. Cyber-worlds begin as emptiness and then introduce *metaphysics* or, literally, something which is beyond the laws of physics, where computation becomes emotional by unifying analytic symbolism with audiovisual imagery (Bricken, 1990, pp. 265-267). As a result, the material no longer dominates the senses in virtual space. On the other hand, however, Johnson (1999, p. 80) argues that ‘our conceptualization and reasoning are grounded in our embodiment, that is, in our bodily orientations, manipulations, and movements as we act in our world.’ He points out that abstractions, including very sophisticated ones, have to be meaningful and ‘retain their intimate ties to our embodied modes of conceptualization and reasoning.’ Furthermore, Beacham (2006, p.6) insists that:

In order to locate ourselves within spaces, we need to be able to take our bearings from the physical elements which serve as the coordinates defining and giving structure to the space, a portion of which we perceive ourselves to be in and occupying. In brief, we are spatially and temporally relational creatures.

Indeed, VR experience may potentially cause a ‘real’ crisis of consciousness in an unprepared user. In order to avoid it, it is necessary to develop further our awareness of how valuable experience within and outside of cyberspace may be. Computer-generated reality is individually customized to the user’s perspective and allows mutually inconsistent environments to co-exist without degradation.

One of the main goals of virtual reality, as stated by nearly all media researchers to date, is to provide viewers with the strongest possible impression of presence (or embodiment) and the maximum intensity of the transported message. Although the possibility of full immersion in VR space is still disputed, it is already more than simply a simulation of reality – everything is already ‘real’ in computer-generated environments. There is no doubt that it is quite complicated to simulate what one sees but, the creation of realism in cyberspace is not necessarily the primary objective. This study argues that it is much more important to design virtual environments, so that they fulfill the existing practical, aesthetical, and psychological needs of their users. VR is a multi-sensorial space where all traditional media are united into a whole. It makes the participants a part of the virtual world, using immersion technologies, but at the same time keeps them quite separate from the virtual because of their ability to interact with VR environments. ‘The consequence of this is that virtual reality is perceived as something, both familiar and estranging, both known and unknown’ (Giannachi, 2004, p. 123). Extraordinary enough, this strongly corresponds with Antonin Artaud’s statement in his 1938 essay *Theatre and Cruelty*:

We want to make theatre a believable reality inflicting this kind of tangible laceration, contained in all true feelings, on the heart and senses. In the same way as our dreams react on us and reality reacts on our dreams, so we believe ourselves able to associate mental pictures with dreams, effective in so far as they

are projected with the required violence. And the audience will believe in the illusion of theatre on condition they really take it for a dream, not for a servile imitation of reality... One cannot separate body and mind, nor the senses from the intellect, particularly in a field where the unendingly repeated jading of our organs calls for sudden shock to revive our understanding.

(Artaud in Corti, 1964, p. 65)

This assertion once again indicates the resemblance between theatrical and virtual spaces. Similar to theatre, the users of VR perceive its 3D computer-generated environments as observers and, simultaneously, as objects who are placed within them (Beacham, 2006). Almost any space can be fictionalized or imitated in virtual space causing perceptual distortions and misinterpretations. Very often, however, it is a desirable experience. For example, the notion of *willing suspension of disbelief* implies a semi-conscious decision, when a spectator accepts the premise as being the *reality* for the duration of the performance or, in this case, interaction with VR environments. The process of experiencing virtual reality should be fluid and discontinuous, where unpredictability and, to a certain extent, credibility are almost necessary conditions.

Certainly, there is also the danger of the term *interactivity* within digital environments being interpreted in a literal way, or, in other words, 'equating it with physical interaction between a user and a media object (pressing a button, choosing a link, moving the body), at the expense of psychological interaction' (Manovich, 2001, p. 57). This view is probably the result of mistakenly discussing the concept of interactivity exclusively in relation to computer-based technologies. Obviously, all classical arts are interactive and employ numerous techniques to coordinate and focus the viewer's attention on different elements of the art-creation process. Contemporary art and modern media attempt to force these modes further, by placing new cognitive and physical demands on the



participants. For example, installation technologies often mobilize human emotions, in order to expand the limits of visualization and the possibilities of visual intelligence. Grau (2003) points out that this longing for transcending boundaries and abandoning the self is an integral part of any civilizing process. One might argue that often, one of the main purposes of using computer technologies in art-creation is to make computation itself invisible. Indeed, design of the interface is gradually dissolving towards more transparent and intuitive forms, in order to avoid the psychological detachment of the viewer from the work of art. Without it, an artwork cannot be perceived as an autonomous aesthetic object, which threatens the very basis of one's appreciation of art – the viewer's ability to seek distance for critical reflection (Grau, 2003, p. 202). At the present state of technological development, the transparency of the medium is not quite possible and, as the present study argues, not ultimately crucial to achieve.

To some extent, computer technologies have become irreplaceable for us to perceive and co-create the real world. However, as Bertolt Brecht stated in his essay *Theatre for Pleasure or Theatre for Instruction*: 'when something seems "the most obvious thing in the world" it means that any attempt to understand the world has been given up' (in Willett, 1957, p. 71). Indeed, technological innovations have already become rather 'obvious things' for many people. Nevertheless, there is still much left to explore and understand.

## 2.5 Educational Paradigm

'The classroom is now in a vital struggle for survival with the immensely persuasive "outside" world created by new informational media. Education must shift from instruction, from imposing of stencils, to discovery – to probing and exploration and to the recognition of the language of forms.'

(McLuhan and Fiore, 1967, p. 100)

In recent years, the notion of a teacher as a source of knowledge in *face-to-face* education has changed. One of the initial changes was that the educator's role started evolving from instructional towards providing support. It partly happened because the WWW began to act as a major digital database for storing information within a structured framework, which offered various ways of assisting the learning process, ultimately enhancing flexibility in the delivery of knowledge. E-learning emerged as a network-based transfer of information, in order to facilitate the process of study through both computer and communication technologies. These novel techniques required learners' interaction and also encouraged active collaboration and participation in the learning activities, perhaps even more than traditionally established methods. This 'e-approach' to education provided numerous opportunities for effective knowledge transfer and skill-training. Furthermore, it enabled participants to proceed through a learning experience at their own pace during a set period of time, encouraging them to focus on study materials. Obviously, computer-based information delivery has many requirements ranging from content consideration to the design of a study interface. For example, the organization of course material must include dynamic links developed through associations and concept mapping, which would enable learners to interact freely with study-resources and also drive their enquiries. Virtual learning environments can be either a flexible educational and training setting or a sequence of events, which require learners to follow a set of instructions, in order to develop their skills for day-to-day operation and demonstrate their knowledge (Forsyth, 1998).

There are a number of educational projects that employ critical approaches to theatre education. They attempt to develop innovative teaching strategies and

propose a new kind of scholarly research. Usually, it is specialized software or online modules that contain virtual environments generated for accessing, investigating, and learning essential elements of theatre-making through experiencing a body of knowledge interactively. These educational projects attempt to help their users in studying the basic principles of theatre, which are difficult to communicate using traditional teaching techniques. These may include set design, lighting, acoustics, sightlines, and also perception of time and space. The THEATRON online module, for example, offers 3D reconstructions of famous theatrical sites, in order to illustrate the precise settings where past theatrical performances took place. Denard (2004) argues that these types of VR simulations are not just a scientific representation of knowledge, but performative objects in their own right. This issue will be further discussed in Chapter Three of this thesis.

Education is naturally a social process, where knowledge is an experience and information is an environment. The ability of cyberspace to create a new multi-participant classroom, where learners are able to compare various forms of delivery and choose one they prefer, in order to accomplish a particular task, is particularly important for this practice-based research. Virtual learning environments generally represent a *hyperspace* with worldwide distribution, which can be modified and experienced simultaneously by different learners separated geographically (Denard, 2004). All of the above considerations imply that cyberspace is now accepted as an educational medium, which considers present teaching and learning needs and which responds adequately. It creates a completely customized, individualized learning process and skill-transfer (Bricken, 1990c); and, furthermore, it enables the learners to dwell within rich,



replicable, and responsive virtual environments, in order to further construct their knowledge.

There is a danger, however, that this rapid switch to e-learning applications will cause a significant damage to the primacy of the teacher, as an interpreter of information. Thus, this study argues, an appropriate technology should be used in relation to a mode of delivery of study material. One might also question the need to reconstruct digitally historical materials, stating that it is probably better to create something new, for example, theatre performance, employing the same technologies, instead of spending valuable time, and of course money, on 're-building' something that already exists in the form of sketches, pictures, schemes and photographs (i.e. as conventional sources of information). Furthermore, some academics fear that technological innovations could potentially affect concentration and deter learners from the actual study process. The current study argues that the creation of the 'new' and reconstruction of the 'old' can be successfully combined and greatly enhance each other. For example, a new virtual performance can be successfully staged within the 'old' 3D-reconstructed theatrical site, using motion-capture technology, or the 'old' show could be revived in the new computer-generated settings. Certainly, such a technological approach to education is still a comparatively young phenomenon with insufficient time for pedagogical or administrative structures to generate accepted practices and standards. Therefore, all educational innovations should be carefully assessed before their implementation in the classroom, both traditional and virtual. Nevertheless, this study finds such a visual approach to learning most useful, especially in the area of theatre design and will apply it practically in the e-Chapter of this thesis.

## 2.6 Art Paradigm

'The sometimes uneasy alliance between art and technology has come of age: the inexorable march of the world toward a digital (or computerized) culture has included art in its step. Digital art is a mechanized medium whose potential appears limitless.'

(Rush, 1999, p. 36)

One might argue that at present, the traditional classification of arts seems dated. The common *-isms* of the nineteenth and twentieth centuries (e.g. Classicism, Romanticism, Cubism, Surrealism, Conceptualism) referred to *intra-art* practices, in which one movement naturally superseded the previous one, but these have not found a continuation in an era of digital art (Rush, 1999, p. 168). This study argues that *supersede* is not the right verb to describe the evolution of the art styles – all of them naturally *co-exist* with each other. It should be noted that to date there is no exact term that refers to computer-assisted imaging. The current expansion of multimedia technologies is now taking place on a much larger scale than in previous centuries; and their influence on the processes of art-creation and art theory is axiomatic. Nowadays, computer-based art and mediated performance have become one of the dominant art forms in our society, which includes a wide range of computer graphics and digitized images, animation, laser shows, cybernetic sculptures, interactive films, and telecommunication events. These new art forms often demand the involvement of the audience to initiate the process of art-perception, enrich its content, and, eventually, finalize it. In the past, visual information was static and an image once created was fixed in its form or it was difficult, if not impossible, to change it. Once translated into digital language every single element of the image can be manipulated and modified endlessly, because it becomes information stored in strings of binary code. This means that, in the contemporary art world, visual literacy is no longer limited to 'the object':

It [visual literacy] must embrace the fluid, ever-changing universe that exists inside the computer and the new world the computer facilitates: an interactive art world that can be virtual in its reality and radically interdependent in its incorporation of 'the viewer' into the completion of the work of art.

(Rush, 1999, p. 171)

Umberto Eco in his essay *Opera Aperta (The Open Work)* introduced the concept of *openness*, focusing on plurality in art from the mid-sixties onwards. He attempted to explain the difference between traditional and modern art, describing the work of art as:

a complete and closed form in its uniqueness as a balanced organic whole, while at the same time constituting an open product on account of its susceptibility to countless different interpretations which do not impinge on its unadulterable specificity. Hence, every reception of a work of art is both an interpretation and a performance of it, because in every reception the work takes on a fresh perspective for itself.

(Eco, 1962, p. 4)

In other words, a modern artwork is 'work in progress' with an 'indefinite reserve of meanings'. Grau (2003) suggests that the work of art as a *discrete object* is disappearing because of the inability of computer technology to record or reproduce the sensual presence of materialism in art, and that 'games and arbitrary interaction do not qualify the computer as a medium for memories and recollections' (p. 207). There is little doubt that virtual environments change the ways we produce and transfer our cultural values, and also transform the means we use to create art. For example, some time ago, digital graphics became tremendously popular and lucrative, forcing a new cultural definition of the computer. Nowadays, the works of art created exclusively for operating in VR worlds, such as 3D reconstructions, digital installations or even virtual



environments themselves, are regarded as artworks that can be experienced only digitally (Botler and Grusin, 1999). Often, however, as Caylor *et al.* (1996) point out, the numerous attempts to exploit the entire graphical capacity of cyberspace lead to an emphasis on the ‘wow’ factor in art projects and to the neglect of work on meaningful substance. This study argues that, similar to traditional art practices, the content and quality of any computer-generated art piece are very much responsible for its acceptance in the art world.

Undoubtedly, there is a strong connection between the evolution of art forms and technological progress. In the world of theatre, for example, the new technologies of stage lighting and sound reproduction in the early twentieth century encouraged the development of new scenographic forms. The artists often searched for inspiration looking to:

the past, to primitive anthropological understandings and models, and at other times have pursued ‘human certainties’ in attempts to analyze and define essential qualities of human perception within which a new, more universally accepted art might be created.

(Baugh, 2005, p. 216)

In an interview with the University of Warwick Research-TV in April 2005, Professor Richard Beacham further supports the above statement by describing the transformation of ancient Pompeian wall paintings into VR representations of Roman theatres:

It's an interesting process because the ancients used a perspective technique which was similar to, but not exactly the same, as what we understand since the Renaissance, as perspective. And that meant that part of the project's tasks, one of the challenges of the project, has been to decode in fact ancient perspective

technology and realize it and understand it and explore it by using modern perspective technology of the sort that we find in computer graphics.

(Available: <http://research-tv.warwick.ac.uk/stories/creative/theatron/transcript/>)

Although cyberspaces act as a present and future art medium, it is necessary to remember that it is also a means to understand and sometimes even rewrite our past.

The fascination with new technologies is nothing new. From the late nineteenth century the Western theatre was widely exploiting technical devices, sometimes to such an extent that new plays were written and new performances were staged for the sake of technology, and in order to profit from new scenographic innovations. In his 2005 book *Theatre, Performance and Technology: the Development of Scenography in the Twentieth Century*, Christopher Baugh highlights the career of the stage designer Bruce 'Sensation' Smith at Drury Lane theatre, who widely used hydraulic stage machinery in 1902 for a series of sensation melodramas. He also argues that the 'classic plays of antiquity and of Shakespeare were presented as little more than glittering *tableaux vivants*, with the words of the text functioning as little more than 'sub-titles' to animated pictures' (p. 181). Soon after, the twentieth century modernity-post-modernity paradigm shift also warmly welcomed new technology, seeing it as 'a major breakthrough to new kinds of knowledge' (Kershaw, 1999, p.6). This shift gave birth to numerous dramatically and technologically sophisticated productions. And currently, the 'wow factor' trend remains very much alive within contemporary theatre practices. The mixture of various media on the theatrical stage has mainly two purposes: firstly, to enhance the very concept of a performance and, secondly, to provide technical support, for example, for theatre

shows which are performed in foreign languages (e.g. subtitles). In both cases, the technology should be used with care. Unfortunately, there are performances, in which live action is negatively affected by the badly ‘prepared’ textual support. The production of Shakespeare’s *Twelfth Night* directed by Declan Donnellan in association with the Russian Theatre Confederation, which was performed in June 2006 at the Warwick Arts Centre in Russian language with English subtitles is a good example of how negatively the failure to integrate different media with care (in this case textual representation – i.e. subtitles) can affect the overall perception of the theatrical act. The text on the screens, specially provided for subtitles in the auditorium, failed to correspond appropriately with the action, creating difficulties in linking the words with the onstage performance.

According to Valery (1964), artists often expect major technological innovations to transform an entire range of techniques in the arts, thereby introducing often fundamental changes in the very notion of art. It is necessary to mention, however, that the interpretation of cyberspace as a space for art-creation is not yet well established, and, unfortunately, current debates in the arts and humanities are mostly focused on theoretical discussions rather than art practices.

## 2.7 The Artist Paradigm

‘...the mediation of society disperses the theatrical by inserting performance into everyday life – every time we turn into the media we are confronted by the representational styles of a performative world...’

(Kershaw, 1999, p. 6)

Since the eighteen century, one of the main goals of contemporary artists has been to switch the role of art from being the private, exclusive arena of the aristocracy



to that of the public (Ascott, 1966). A century later, the invention of photography and the further development of the printing press made this ambition easier to realize. In the twentieth century, artists were preoccupied with the idea of achieving the most creative results by:

integrating traditionally separate disciplines into single artworks. Modern experience, many of these artists believed, could be evoked only through an art that contained within itself the complete range of perception. 'Old-fashioned' forms limited to words on page, paint on canvas, or music from an instrument were considered inadequate for capturing the speed, energy, and contradictions of contemporary life.

(Packer and Jordan, 2001, p. xviii)

Above all, however, artists attempted to create more flexible structures and images, offering a variety of possible readings. These actions placed the artist-artefact-spectator relationship in a more behavioural context than in the past. The public began to participate actively in the act of creation on all levels of experience – conceptual, emotional and physical. Nowadays, virtual reality techniques simply enable this participation on a different, perhaps even higher, level.

According to Grau (2003), there are at least three paradigms with which contemporary artists work: (1) the paradigm of illusion, (2) resemblance to life, and (3) presence in other places. These creative practitioners experiment with new technologies, encouraging an art-consumer to interact closely with a machine, in order to create further interconnections between two of them. The main goal here is to enable the user to participate in, either fully flexible, or pre-programmed routines for the purpose of manipulating works of art. Such complex interaction together with the visual language of digital technology empowers artists to

implement new forms of *production* – as opposed to *reproduction* (Rush, 1999, p 168). Indeed, computer-generated environments are a logical extension of arts integration and, furthermore, as some researchers argue (e.g. Packer and Jordan, 2001), an ideal place for applying the existing knowledge of human-computer interactivity. Thus, virtual worlds should not be defined in the context of their intended interpretations, but rather by the artefacts left behind. The argument here is that VR is not only a means for reproducing existing art styles and objects for the purpose of storing, studying, or simply distributing them for mass-production, but also a platform or, in other words, a virtual studio for art-creation. Eventually, virtual space could also be considered as an art form in its own right.

Despite all technological advances, however, it is still unpredictable to what extent their further evolution will influence artistic vision. The artist's apprehension of technology is changing in ways that dramatically affect and often transform the process of art-creation. Therefore, even nowadays, there are still only a few artists who employ, for example, virtual reality as a tool for making art. One might argue that contemporary digital artists are very much motivated to initiate a dialogue with potential audiences and enrich their own artistic experiences through the spectators' responses and feedback. Very often, however, we can observe that many artistic experiments, such as virtual reality theatre, are again an exclusive art-form that is locked in institutions and research centres, to be consumed by the academic elite, but not the general public. Attempts to break with this tradition have undoubtedly been made. For instance, the VR performance of *A Midsummer Night's Dream* designed by Mark Reaney – a fine example of how VR technology can be integrated into the very body of a performance – was staged in June 29 – July 1, 2000 in the Lumley Studio Theatre

at the University of Kent at Canterbury. It should be noted, however that it was shown to the general public only during the above period of time (three performances and one preview) and since then has existed only in digital format.

Wassily Kandinsky in his essay *On Stage Composition* wrote:

Every art has its own language, i.e. the means intrinsic to it alone. Thus every art is self-contained. Every art has a life of its own. It is a realm unto itself. That is why the means of different arts are externally altogether different. Sound, color, word! ...

(in Vogt, 1980, p. 122).

Indeed, different forms of art are unique in their definitions and use specific technologies of representation. Very often, however, it takes time for them to be accepted as an *art form*. Some time ago it happened to cinematography and, in its early years, also to virtual reality. VR was often considered as 'some sort of awful mechanized version of the true art' (Zellner, 1999, p. 22), and even at present its significance for the art world has not yet been fully assessed. Nevertheless, this study emphasizes that virtual reality is simply an extension of existing technological capacities, which provides numerous opportunities for the artists to be creative, communicative and share their experiences.

## 2.8 The Audience's Paradigm: Applying a Human-Centred Approach

'Can theatre exist without an audience? At least one spectator is needed to make it a performance.'

(Grotowski, 1968, p. 32)

Audiences, spectators, viewers are cultural phenomena, fully in charge of the status of any art event or theatrical performance. Since the 1980s, the further



development of a theory of audiences has been strongly debated within various research disciplines. Theorists (especially in North America) criticized heavily ‘the devaluation, or even total rejection, of the text by performance artists’. They perceived this as ‘the final straw in the alienation of audiences, sending them to the (culturally inferior) entertainments of cinema and television’ (Bennett, 1997, p. 14). On the other hand, Carlson (1989, p. 83) emphasizes that:

generic expectations and relationships to other works (intertextuality) are clearly as relevant to theatre reception as to reading, and the juxtaposition of fiction and reality perhaps even more relevant, given the particularly central role played by mimesis and iconicity in the theatre.

Indeed, it can be argued that every theatrical performance is already some sort of reading, even without straightforward textual representation. Furthermore, many theatre researchers (e.g. Rothenberg, 1977) were fascinated by the idea of diluting the audience, as such, within theatrical space. For example, some of the real time audience members could be invited to the theatre at the same time as the performers arrive, in order to be included in every aspect of the theatrical event: ‘from the unlocking of the theatre through costuming and make-up to the arrival of the regular time audience, and on to the clearing-up process and the final shutting of the theatre’ (Bennett, 1997, p. 11). There is little doubt that various experiments with audience participation can be highly successful; however, there are also many examples in the history of theatre when audience members responded to the performance (mostly experimental) in an unpredictable manner, which had not been foreseen by the creators of a theatrical event. The argument here is that even the abandonment of such a visible theatrical convention as the

traditional stage-audience relationship does not necessarily mean that theatre loses its overall *theatricality*.

The relationships between the audience and theatrical productions are traditionally complex. The audience is a group of individuals, which implies that each spectator is a person with his/her own principles, experiences and attitudes, and, simultaneously, a member of a diverse group of people. Obviously, it is not always possible or even necessary to describe each individual response to a particular production. However, there is a need to study particular audiences in their social, material, and historical context. New media technologies can serve here as new tools to aid research and a deeper understanding of the *production-reception* dynamic of theatrical events. The ways the audience responds to a virtual performance is similarly important as in the 'real' theatre. However, there are some issues raised only in connection with virtual spectacles, which should be addressed in this thesis. For example, one might argue that wearing devices, which are necessary for perceiving a VR show (e.g. i-glasses or Head-Mounted Displays) can potentially cause the elimination of the spectators from the communal theatrical space. Reaney (2000a), however, emphasizes that even while wearing these devices the audience is still able to see live on-stage action, computer graphics visualized on rear projection screens, and live video images projected within the HMDs. Although by using these *see-through* technologies, theatre audiences can maintain a strong connection with a real-time live performance, it should be noted that the fluency of interaction between performers and spectators at existing virtual reality venues is not yet equal to traditional theatre. Therefore, this study argues that a VR show should not simply copy

traditional spectacles, but rather emphasize its intrinsically different quality, in order to develop a unique impact on the audience members.

It has already been established in this thesis that the advent of computer technologies and especially virtual reality is very much in charge of redefining the boundaries of our cultural experiences. Such issues as scale, concreteness, abstraction, aesthetics and interface have received new meanings in cyberspace. Furthermore, such researchers as Solomon (1988) and Osberg (1997) point out that VR also offers an opportunity to create a new system of symbols, which is used for the better understanding of existing information and for building up new blocks of knowledge. Furthermore, they suggest that by using these visual and auditory symbol systems of virtual space, there is a chance for audiences to re-estimate their perceptual, cognitive and emotional concepts and re-assess the issues of consciousness, community and connectedness in a social sense.

Multimedia technologies and virtual reality often serve as a means to help the audience members sacrifice realism for the sake of the theatrical experience. In terms of perceptual richness, however, VR goes at least one step further than multimedia applications. Osberg (1997, p. 5) indicates that the primary difference between the two is in intent – multimedia is simply a *representation*, whereas virtual reality is a *simulation*, whose intention is to deepen the suspension of disbelief even further. Nevertheless, there are still many arguments about implementing advanced new media technologies in theatrical space, as well as using them as self-sufficient performance platforms. One of the reasons is the risk of socially excluding the members of the audience, as this can occur, if wearable technological devices conceal human aspects, by providing a buffer between actors, the audience and the performance.



Some researchers (e.g. Weibel, 2002, p. 53) are convinced that future interactions between theatrical images and their spectators will be characterized as *bi-directional*, where the audience transforms into a 'locally-based or net-controlled narrator'. Unfortunately, to date, there are no definite answers to these assumptions and fears. There are no doubts that computer technologies and cyberspace play an important role in contemporary theatre; and that by now they can be considered as an acknowledged vehicle for transmitting theatrical events to distant audiences. Virtual reality has challenged the very nature of theatre, shifting it further towards interactivity. It has had a deep impact on the interconnection between audience, author and theatrical action, greatly enhancing their relationship. However, there is a concern that at present, the evolution of dramatic language sometimes seems to be more dependent 'on the speed of engineering, rather than on developing possible genres' (Rieser and Zapp, 2002, p. xxvi). Nevertheless, it is obvious that there is a constant need for creative practitioners to gain and implement new knowledge, whilst at the same time being aware of the possible detrimental effects of new media technologies on the processes of theatre creation and perception.

## 2.9 The Design Paradigm

'The real value of computers lies not in their ability to save hypothetical quantities of time, but in the possible ways they allow design information to be effectively incorporated into scenographic design projects.'

(Payne, 1994, p. 226)

The ability to visualize knowledge is a fundamental skill in theatre-creation. Carver and White (2003) argue that it serves to bring together the outcomes of

research, creative notions and technical *know-how*, in order to decide which idea should be used as the main concept for a set design.

There is little doubt that modern audiences are spoiled by the innovative technological effects used in contemporary communication and entertainment media. Very often theatre is also expected to provide a high level of special effects, for the sake of amusement. It is necessary to emphasize, however, that theatrical reality, as opposed to the cinematograph (especially Hollywood blockbusters) and television, goes far beyond simply using any technology *per se*. For example, the *poor* theatre of Peter Brook where ‘a man walks across an empty space whilst someone else is watching him’ is more than enough for an act of theatre to be created (Brook, 1968, p. 9). Nonetheless, throughout theatre history, there were numerous attempts to use technological capacity on stage to its very maximum. Very often these endeavours were highly appreciated by audience members, but also widely criticized by contemporary critics, accusing them of eliminating theatricality for the sake of technology. However, the audiences’ ‘thirst’ for being entertained through spectacular effects still exists and is especially noticeable in the area of musical theatre. This fascination encourages set designers to experiment heavily with new techno-tools and, as one might argue, cause the shift of their interest towards the aesthetics of the computer model of the set, rather than the appropriateness of the design for a particular performance.

Nevertheless, there are also numerous advantages to employing a computer as an assistant for modelling various set designs. It simplifies editing work, in which various scanned images or other visual objects are easily included, and every scene or object can be saved at any point during the creation process.

Furthermore, the integration of light, animation and kinetic elements enhances the storyboard and makes it look realistic. The rendered model is navigable, can be viewed from any direction, and can be transported via email, facilitating communication between specialists involved in the production. There is no doubt that the possibilities of working in digital space provide creative inspiration and make workflow more efficient, by moving easily between graphic programs, digital models and schematic output (Carver and White, 2003). On the other hand, however, even specialized software is not always able to solve every technical design issue, and it can also be expensive and difficult to learn. In addition, it is impossible to interact physically with a computer model, and the real stage will never look quite the same as its computer-generated prototype. Carver and White (2003) also argue that the ability to make endless revisions is another big disadvantage of computer-based design projects, because it might greatly affect any intended outcomes, by leaving the stage design in a constantly unfinished state. Nevertheless, despite all the difficulties of using virtual environments for the conceptualization and creation of set designs, computers are an integral part of the contemporary theatre landscape and, if used sensibly, can help creative practitioners throughout different stages of visualization and implementation processes in the theatrical space.

### **2.9.1. Designing Virtual Environments**

In the context of this thesis, it is necessary to analyze how virtual reality is placed within design practices. It is especially important for the practical component of current research, which attempts to closely address many important design principles. In assessing virtual environments as a place of visualization, as well as



‘a habitat for imagination’ (Novak, 1991, p. 253), it is necessary to outline one of the main goals of cyberspace, which is to promote natural interaction similar to that in the physical environment. It was already established that one of the ways to achieve this is by making digital technology transparent and the physical interface *interfaceless*, meaning that the user is no longer aware of being face-to-face with a digital medium. It also implies that there are no recognizable electronic tools (i.e. windows, icons, scroll bars, or buttons), which enable the user to get involved in an immediate relationship with the medium contents (Botler and Grusin, 1999, p. 23). According to Bricken, (1990a), there are several paradigm shifts between traditional interface design and design for virtual environments. First of all, the advent of new technical devices enabled their users to *walk through* the screen surface into inclusive VR worlds. This innovation was a major technological breakthrough that irreversibly transformed the participant-cyberspace relationship. The computer interface with its functionally organized on-screen data enabled *inclusion* of the users in the computer-generated environments and empowered their direct interaction with various forms of information. The second shift took place when virtual environments became adapted to natural human behavior within them. Despite this adaptation, however, some training of participants prior to entry into cyberspace is still necessary. For example, in VR-based theatrical productions it is crucial to provide preliminary actor-training on how to communicate with computer-generated characters and to use parts of the scenery that are invisible to the participants during the actual performance. The next step is to transform the cyberspace users into active agents, who are capable of creating applications themselves and by doing, so co-create the matrix of a virtual world.

Finally, the last shift to date was conditioned by the invention of *acoustigraphic* environments, where all movements of the participants involved in a VR experience are multimodal or, to be more precise, can be coordinated with visual representations, as well as ambient and localized sounds. There is little doubt that the role of sound within virtual environments is very important for the psychological assessment and the internal mapping of computer-generated spaces. This study, however, is mostly concerned with analyzing the visual qualities of virtual worlds, leaving the issue of acoustics in VR as a future research direction. All of the listed developments and also future shifts in virtual reality-user interaction require designers to work closely with engineers and computer scientists; however it is also necessary to focus on the people, who use the technology – i.e. VR participants.

Virtual reality is able to help in realizing one of the fundamental objectives in the design process – three-dimensional perception. There are a number of specialized digital products that are widely used to assist in the creation and development of various technology-based design projects. For example, computer programs for CAD (i.e. Computer Aided Design, Computer Assisted Design or Computer Assisted Drafting) are commonly employed by engineers and architects for improving their technical skills and producing precise drafts and plans. This type of software allowed the presentation of complex and easily redrawn images and also enabled artists and designers to develop their visual projects more accurately.

It should be noted that the entertainment industry (particularly, film, television and computer games) has always been a significant force, driving the development of graphic computer programs. The advent of 3D graphics or 3D

modelling had a revolutionary impact on image production. This type of computer software emerged as a hybrid between CAD and paint programs and offered a combination of vector-based geometry and pixel-based painting. The ultimate goal of many 3D modelling projects is realism in the final draft, reflected in the accuracy of the properties assigned to the objects' surfaces and the lighting effects upon them. This type of graphic program is widely used in various fields of design practice, including theatre. In theatrical space, visualization is the main tool for the creation of a readable, communicable and interactive environment. Undoubtedly, this can be achieved through conventional designing practice, but it can be further enhanced through the employment of the newly available technological means. Virtual reality is a data environment, where interaction between the system and its users happens on different levels of communication including visual, audio and tactile stimuli with various levels of intensity. This implies that the technology attempts to become invisible and enable the participants to behave naturally in this artificial world, adapting to human activities. However, the overall success and comfort of the participant-VR interaction depends chiefly on how well virtual environments are designed.

There is a set of principles each designer, regardless of the area of expertise, should have knowledge of, in order to accommodate a wide range of demands and to communicate a design concept clearly. This study attempts to clarify what 'good' design should be and adapts some of what Story (1998) considers being the principles of universal design (Table 2).



TABLE 2: The Principles of Universal Design. Adapted from Story (1998)

Principle	Brief Explanation
Equitable use	The design is useful and marketable to people with diverse abilities.
Flexibility in use	The design accommodates a wide range of individual preferences and abilities.
Simple and intuitive use	Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
Perceptible information	The design communicates necessary information effectively to the users, regardless of ambient conditions or the user's sensory abilities.
Error tolerance	The design minimizes hazards and the adverse consequences of accidental or unintended actions.
Low physical effort	The design can be used effectively and comfortably and with a minimum of fatigue.
Size and space for approach and use	Appropriate size and space are provided for approach, reach, manipulation and use regardless of the user's body size, posture or mobility.

Morton Heilig, a cinematographer of the 1950s, predicted that user-technology interaction would soon involve not only the senses of sight and sound, but also taste, touch and smell. As a matter of fact, this is already happening in, for example, various theme parks and IMAX cinemas around the globe, in particular types of military training and medical simulations. Undoubtedly, VR modelling is becoming more and more realistic; however, it should be borne in mind that there always will be limits to realism in the use of specialized computer software for designing virtual environments.

2.10 The Technological Paradigm

To some extent, the terms *computer technology* and *digital technology* have become interchangeable. Gere (2002) argues that *digitality* emerged as instantaneous communication, global connectivity and ubiquitous media that are in charge of almost every aspect of our everyday experience. It refers to the capabilities of a particular technology, and also to the ways of thinking

incorporated within, stimulating further technological evolution. In other words, digital technology combines both technical and creative components, including abstraction, codification, and programming. It produces a vast range of applications and media forms, such as virtual reality, digital film and television, electronic music, computer games and various special effects for the entertainment industry, including theatre. At present, digital technology is so well-integrated that it appears almost ‘natural’ due to its ubiquity and increasing invisibility. In order to explain further the technological evolution, it is necessary to look back into the logic of its progression. Manovich (2001, pp. 161-164) distinguishes two distinct trajectories in the development of new media. The first one is *representational* technologies, such as film, audio and video magnetic tape as well as various digital-storage formats. The second trajectory is *real-time communication* technologies – telegraph, telephone, telex, television, telepresence and also virtual and augmented realities (AR). The development of representational technologies has already been explained in Chapter One. Here, it is necessary to analyze in more detail contemporary real-time communication technologies, outline similarities and differences within them, and discuss their relevance to the world of theatre and education.

Manovich (2001, pp. 165-166) defines *telepresence* as one example of communication technologies, which ‘used to enable action, that is, to allow the viewer to manipulate reality through representations’ and claims that its concept has been excessively played down by the popular media, in favour of virtual reality. From an historical viewpoint, one might argue that telepresence is a much more radical technology than, for example, virtual reality and computer simulations. First of all, it is capable of manipulating remote physical objects in

real time through live video images, which are presented in a synthetic computer-generated environment. Secondly, and more relevant to this study, telepresence remediates the monitoring function of broadcast television and closed-circuit video, by using video signals and computer graphics to place its users at a remote or inaccessible location. This ability is significant for the world of education. It allows a virtual teacher to be presented as a holographic image in front of the geographically remote students to conduct a real-time lecture. Telepresence differs from video conferencing in a way that it provides more natural communication, establishing perfect eye contact between its users, which is achievable by employing specific optically-embedded camera technologies. By contrast, video-conferencing is typically a two-way video system with cameras usually placed on the top of the monitor, making participants look at each other's images instead of the cameras, which proved impossible for the maintenance of constant eye contact.

It should be noted that augmented reality employs techniques, similar to telepresence and virtual reality, by placing computer graphics or video in front of the participants. The AR users can see the real and virtual world simultaneously, meaning that instead of blocking the real environment, the computer 'overwrites' and comments on what a spectator sees (Botler and Grusin, 1999, p. 215). The main difference between telepresence and augmented reality is that AR offers a *hypermediated* experience, where its users are very much aware of computer graphics as a medium; while during the telepresence lecture, students could potentially forget that the knowledge delivery happens through the holographic image of a real teacher.



Botler and Grusin (1999, pp. 213-216) further argue that in contrast to augmented reality and telepresence, VR acts as a graphics engine and represents the next level in the creation of a 'transparent' medium. Nevertheless, it still remains relatively dependent on previous technological applications and on our ability to associate it with earlier visual media. In order to understand fully how VR and AR applications function, it is necessary to outline various devices employed by these media and analyze their purposes for computer-participant interactions. As mentioned above, virtual reality has a great potential to be the next *human-computer* interface and revolutionize the use of computer technologies for co-operative interaction and communication in 3D, shared, virtual space. The ultimate goal of VR devices is to interpret the activities of a real-time user into digital data. A wide range of hardware, such as projectors, table-tops and ordinary desktops, were specifically designed for viewing computer-generated environments. Projections can be applied onto large concave screens (similar to the ones used in IMAX theatres) in front of the users or within their walking route. Various devices including Head Mounted Displays, data-gloves, and body-sensors serve to deliver users' feedback, while interacting in VR environments. The illusion of being fully immersed in an artificial world can be enhanced further by various visual and non-visual technologies. For example, as Beier (1998) argues, the head-referenced viewing, typical for immersive virtual reality, provides a natural interface for the navigation in 3D space, and allows the user to look-around, walk-around, and fly-through the scenery in virtual environments. This stereoscopic capability to view VR worlds, which are perceived in full scale and relate properly to human body size, enhances the perception of depth and the sense of space. Some of the important virtual reality

devices designed for optimal interaction with computer-generated environments are outlined in Table 3. A further and more detailed overview of VR tools is provided in Appendix One of this thesis.

TABLE 3: Virtual Reality Devices. Adapted from Bricken (1999a)

VR Devices	Description
Head Mounted Displays (HMDs)	Opaque – for immersion in the virtual world; Transparent – for virtual worlds superimposed on reality; Acoustically coupled – for 3D sight and sound; Eye-tracking coupled – for control by looking; Microphone or ear-mike transducer coupled – for hearing and voice commands.
VR Peripherals	Computerized clothing that recognizes physical gestures as commands; Systems that track the movements of the body; Trackballs and joysticks that allow movement of perspective; Feedback devices that use force, pressure, or vibration; Remote operation systems that translate human movements into the control of machinery.
Tools for interaction in VR	Virtual world and matrix operating systems; Interactive 3-D graphics construction and animation packages; Specialized information structures and query systems; Multi-modal data visualization and display techniques; Spatial fields and topologies; Autonomous agents and entities.

There is little doubt that the representation of *self* is fundamental to virtual interface design (Bricken, 1990b). Computerized clothing, motion capture technology and other physical devices create the illusion of a direct interaction within cyberspace, but also act as a primary reference point or, in other words, as an interface between the users and VR environments. These innovative applications were specially created to give the participants an opportunity for displaying themselves in virtual environments in any chosen shape or costume,

simultaneously providing a complete record of undertaken actions. This virtually *interfaceless* experience of VR worlds is probably the most *natural* human-computer interaction to date. This study argues, however, that the recent widespread use of ubiquitous computing has the potential to bring about a new trend in developing advanced computer applications in ways contrary to those of virtual reality, turning everything into a computer interface.

### 2.10.1 Mixing Realities: Implication for the Theatre

In this subsection, I will discuss the ways of merging real and virtual environments (i.e. *mixed reality (MR)*), in order to achieve the best possible interaction between the spectators/participants and VR event. Milgram *et al.* (1994, pp. 2-4) explain how real spaces can be connected to virtual ones, by introducing the *Reality-Virtuality (RV) Continuum* (Fig. 1):

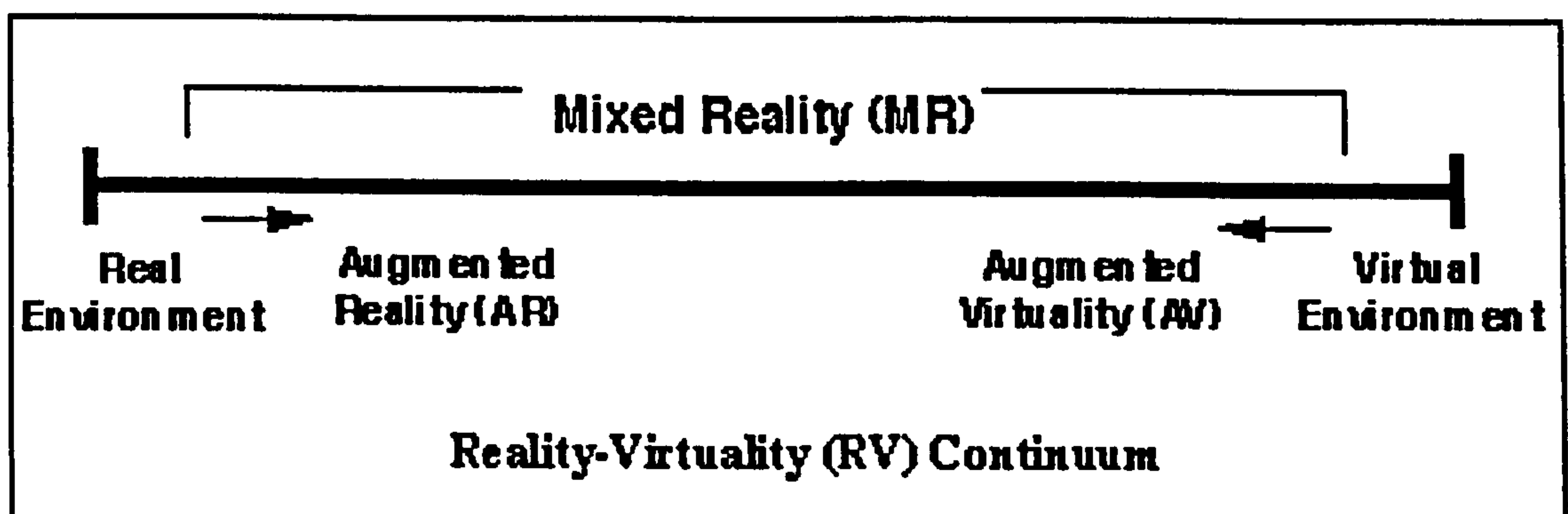


FIGURE 1: Reality-Virtuality (RV) Continuum. Source: Milgram *et al.* (1994)

Here, real and virtual environments are referred to as the *continuum*, as opposed to an antithesis. One end of the continuum contains a real environment that consists only of real objects and can be viewed directly in person, or through some kind of display. By contrast, another extreme consists solely of virtual



environments, such as monitor-based or immersive computer graphic simulations. Augmented reality here pertains to any environment, which is simply enhanced by means of computer graphics, otherwise, completely real. And, eventually, augmented *virtuality* comprises the enhancement of completely virtual environments with real images and objects. Within this framework, mixed reality refers to ‘the class of all displays in which there is some kind of combination of real and virtual environments’ (Milgram and Drascic, 1997, p. 1).

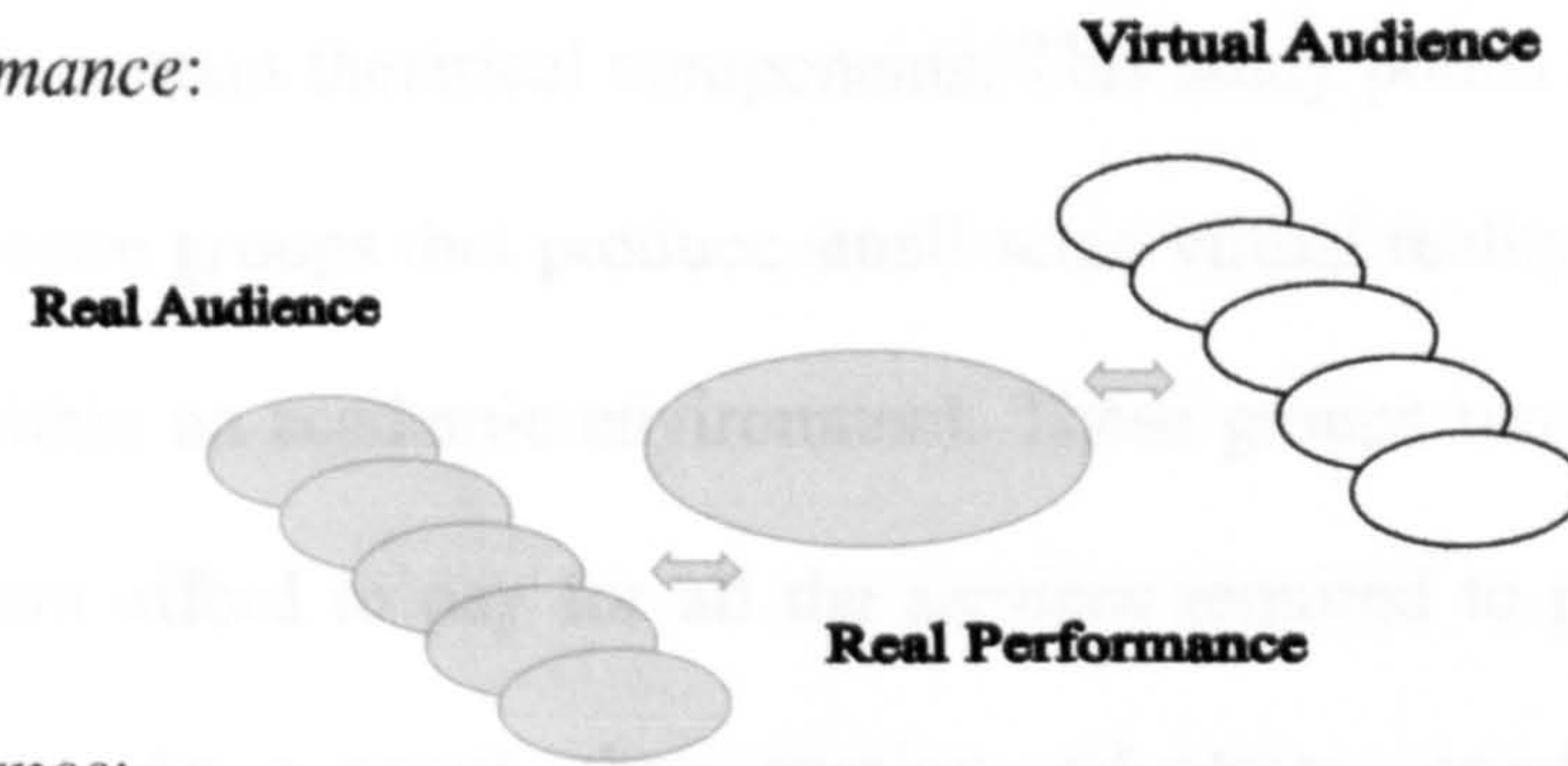
According to Billinghurst and Kato (1999), MR systems can be divided into two major groups: *video see-through* mixed reality and *optical see-through* mixed reality. This division depends on the relative proportions of display methods used. While employing video MR, the interaction with the real world is slightly unnatural. It happens because all virtual objects are superimposed on a live video image of a real environment and displayed back into the user’s eyes. This image is captured by the camera attached to an HMD, the viewpoint of which being offset from the user’s own, so that the image it produces is not stereographic. The main advantage of this system, however, is relatively easy implementation. In contrast to video MR, the second system shows virtual objects directly in the real world by using see-through displays. Virtual images are stereoscopic and can be generated in such a way that the interaction with them seems to be natural, and the user sees the real world in a direct way. This makes optical see-through displays more reliable for the simultaneous viewing of virtual and real environments without distortion of the images and, as a result, this is to date the best for use in theatre for perceiving performances with virtual scenery and real actors.

Both virtual and augmented (including MR applications) realities have a great potential to enhance and even completely transform theatrical space. The main difference between the two, however, is that whereas VR aims to replace the real world – AR supplements it (Feiner, 2002, p. 1). The users of AR applications have access to a combination of virtual and real-world attributes by superimposing graphical information over real space. Interestingly, the key characteristic of collaborative augmented reality would be *virtuality* that allows the objects that do not exist in the real world to be viewed and examined in computer-generated reality. This enables multiple participants to control their own independent viewpoints, in order to see each other, cooperate in a natural way, and, overall, avoid a feeling of social exclusion. In addition, the displayed data can vary from viewer to viewer, which intensifies face-to-face interaction and allows AR users to collaborate seamlessly and simultaneously with both virtual and real environments. At present, however, the majority of AR researchers are concerned with the use of live video imagery, which is digitally processed by the addition of computer generated graphics.

In theatrical space any interaction between the spectators and on-stage action, which is enabled by new technologies of computation and which include virtual and augmented realities, has two sides – real and virtual. The audience members can be present in the actual theatre and, simultaneously, in virtual space perceiving the same virtual or real-time performance (Fig. 2).



*Real-time Performance:*



*Virtual Performance:*

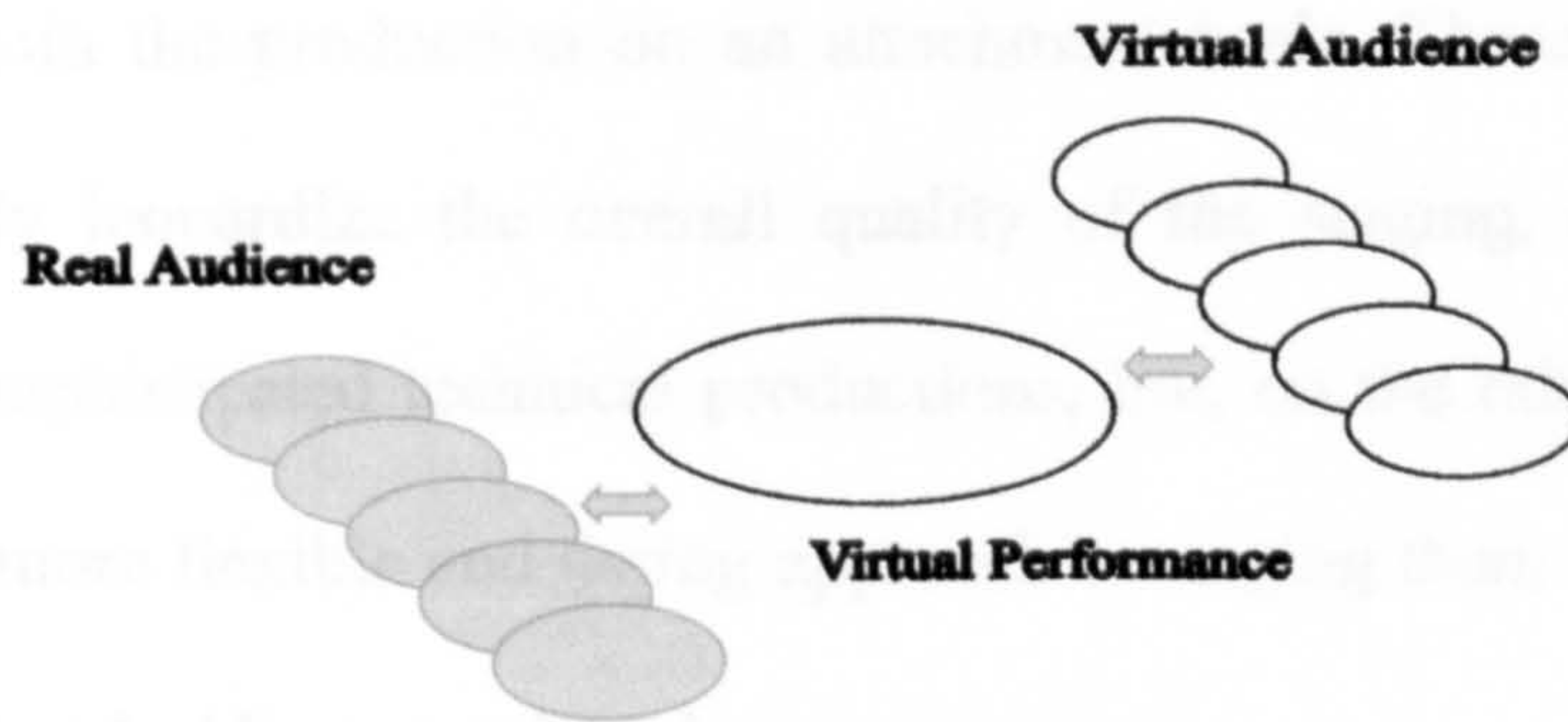


FIGURE 2: Two Sides of Interaction in Real and Virtual Theatrical Space. Author: Iryna Kuksa

The first kind of interaction could only occur if a theatrical event happens in real-time and space. Here, some of the audience members are physically present in the auditorium, while others are virtually represented (e.g. as holographic images) through telepresence devices. The *virtual* spectators have nearly the same opportunity to influence the flow of the performance, responding to the on-stage action and contributing to the creation of a special theatrical atmosphere. In the second case, the spectacle, as well as being performed live in virtual space using, for example, the Internet engine or motion capture technology, could potentially be pre-recorded. If this happens, however, VR theatre then could become similar to theatre performances on television.

Despite recent progress in staging performances which employ virtual reality applications, there are still numerous arguments about whether VR is simply ‘escapist’ entertainment, where dramatic elements disappear behind technology, or whether it is an utterly self-sufficient and satisfying environment,



that contains all important theatrical components. This study points out that there are only a few theatre groups that produce small-scale virtual reality productions, usually shown within an academic environment. These groups run on very tight budgets and cannot afford to pay for all the services required to produce a big professional show. As a result, they employ volunteers, usually university students, who join the production on an attachment basis. These arrangements could potentially jeopardize the overall quality of the staging, affecting even comparatively sophisticated technical productions; but, on the other hand, could also promote a more flexible and daring approach to staging than, for example, if professional actors had been employed.

## **2.11 Concluding Remarks**

Virtual reality is invariably exploratory and seeks to reflect upon existing conventions, evolve new concepts, engage with experimental practice and draw freely on the widest range of references, influences and disciplines. It has been understood as an artistic, creative and presentational medium that is responsible for the origination of new modes of social engagement, employed by various museums, galleries, libraries, theatres and research centers. In the course of time its content has matured and created a new cultural dimension. It has provided valuable insights into the nature of creative interactions and contributed greatly in art, theatre and design, in a broader context. The advent of virtual reality creates an opportunity to redefine the boundaries of our cultural experience. Central issues such as scale, concreteness, abstraction, aesthetics and interface can be re-explored, and through the critical evaluation, receive new meanings in the virtual world. The areas of VR implementation are various – from medicine and military

simulations, where the most impressive breakthroughs are accomplished, to archaeology and theatre education, where a number of VR applications have been used for 3D reconstructions of partially or completely demolished theatrical sites. Despite the fact that the number of practical applications for virtual reality in theatrical space remains relatively small and our experience of it is still quite limited, the existing experimental productions are of major importance for defining tendencies in the future development of contemporary theatre.

These innovative technologies refer to real actions, people and objects, increasing the communication bandwidth and enabling a smooth transition between real and virtual spaces, through developing various types of interfaces for face-to-face and remote communication. As a result, the intuitiveness of interaction is constantly increasing without additional requirement for graphic renderings. There is little doubt that the relationship between digital technology, modern art and theatre has a considerable effect on how contemporary visual culture is experienced. This research attempts to illustrate that, despite the fact that new media have already become an integral part of our everyday lives, it is not yet completely clear how our culture responds to these new virtual environments from ethical, aesthetic, psychological and overall cultural perspectives. Nevertheless, the most productive and dynamic work occurs when the technology-driven medium is found, or, in other words, when the artistic vision coincides with the existing technology.

The next chapter is a development from the Educational Paradigm subsection and will investigate and critically discuss the impact of cyberspace and digital technologies on the theoretical and practical aspects of contemporary theatre education and creative practice.

## **CHAPTER THREE: VIRTUAL REALITY IN THEATRE EDUCATION AND DESIGN PRACTICE – NEW DEVELOPMENTS AND APPLICATIONS**

**‘Under electric technology the entire business of man becomes learning and knowing.’  
(McLuhan, 1964, p. 58)**

Modern technologies of computation greatly influence the process of theatre-making, especially contributing to design and implementation phases. They also have a profound impact on theoretical and practical educational aspects of the performance studies classroom. Often in theatre education the subject of study can be delivered only verbally and the possibility of an external visual element of learning is missing.

Experiencing theatre as words and conceiving it televisually are the two main factors blocking students from envisioning the spatial properties of live theatre. As Jerzy Grotowski and Peter Brook have concluded, the fundamental elements defining all theatre are an actor, space and an audience. To fully comprehend the dynamics of space needs the visual skills of a sculptor, designer or architect which most theatre teachers, let alone students, do not possess.

**(Beardon and Enright, 1999, p. 7)**

Various technological innovations can promote the visual side of the course material, instantly offering a more improvisatory approach to the whole visualization process. Furthermore, new technologies can assist students in their self-directed learning and encourage active participation and collaboration with study material, rather than passivity in its consumption. In this chapter, I argue that the technology-oriented new teaching techniques can benefit the whole



process of learning, through experimenting with existing course design and by transforming the established methods of knowledge delivery.

This chapter develops from the Educational Paradigm subsection in Chapter Two and investigates further the impact of cyberspace and digital technologies on contemporary theatre education and creative practices. In this chapter, I use tables and figures to support my analyses and evaluations. Here, I outline some important models of learning and analyze a paradigm shift in the role of the teacher in the contemporary classroom. Coming from a scenographic perspective, I explore the advantages and disadvantages of such relatively new media communication platforms as the Internet, 3D simulations, and avatar technologies, discussing their impact on knowledge transfer in the field of Theatre Studies. Furthermore, I argue that computer-mediated learning should be carefully balanced between the consumption of information and an active and also creative engagement with available media. To support my argument, I provide a critical overview of the existing computer-based projects, with particular focus on two case studies, both of which are significant in evaluating recent tendencies in the use of technologies of computation for creative and educational purposes. I attempt, firstly, to explain the major reasons for employing new technologies and, secondly, investigate their relationship with conventional teaching and learning techniques through evaluating their overall effectiveness. These evaluations are very important for the development of the practical component of this study – the Set-SPECTRUM educational project, presented as the e-Chapter of this thesis.

### 3.1 Computer-Based Teaching and Learning Strategies: Advantages and Disadvantages

In recent years the process of education has noticeably changed. Recent evidence suggests that there has been a paradigm shift towards an emphasis on teaching and training as a lifelong process. Nowadays, the role of the modern teacher can be defined as that of an interpreter of course resources. At present a greater emphasis is on the students and their active engagement with study materials. Forsyth (1998) suggests that this evolution from the passive consumption of information to active engagement with it has enabled learners to control their study-process. In order to understand fully the aforementioned developments, it is necessary to examine the major models of the different ways, by which we consume new knowledge.

Enlung (2001) distinguishes four important types of learning. The first type is *performance learning* or, to be more precise, learning in situations such as in a conventional classroom, during a lecture or presentation, where the learner is a relatively passive observer and receiver of information. *Collaborative learning* is the second type, which encourages studying in teams of peers in structured and goal-oriented activities, such as project groups in problem-based learning. The next mode of knowledge consumption is *social interaction*, which stimulates learning in serendipitous, unstructured social situations, where a spontaneous exchange of ideas, information, or experiences takes place, e.g., during a chance meeting at the coffee machine or at the newsstand. Finally, the last type of learning consists of *individual study*, where the delivery of knowledge occurs through solitary activity, cognitive or physical, as in reading, writing, solving problems, experimenting, practising, and reflecting. This study seeks to address

the question of how computer technologies can be incorporated naturally within various study-models and learning environments, and attempts to illustrate this integration by focusing specifically on the study environment of HE institutions, research centers, and study units in museums and galleries.

Technological innovations constantly increase the demand for reforms in the educational sector and, as a result, make the linkage between teachers' professional development in appropriate uses of technology and students' achievements much stronger (Valdez *et al.*, 2000). Recent developments in the area of new media technologies heightened the need for more interactive, enjoyable, and customizable learning. Technology offers numerous opportunities for monitoring the process of study and, consequently, increases motivation, improves students' attitudes towards course material, as well as their interest in gaining new knowledge. At present, it acts as an inseparable part of the teacher-student interaction and cooperative information exchange, becoming a necessity, for example, for e-learning. Indeed, computer-mediated study not only amplifies, extends, and enhances learners' cognition (Jonassen and Reeves, 1996), but also facilitates access to human, material, and technological resources and helps students to store, reshape, and analyze necessary data. Valdez *et al.* (2000) state that technology provides a rich space for learners to collect quality information from various areas of knowledge, and also to discover and understand conceptual relationships between learning resources that were previously segmented and utilized in isolated contexts.

There are several significant phases in the development of technology-empowered learning and teacher-student-computer interaction, detailed description and analysis of which are provided in Appendix Two of this thesis.



Valdez *et al.* (2000) points out that new technologies serve as a catalyst for improvement of content areas, as well as the students' ability to perceive and learn specific information. Such applications as hypertext and hypermedia enable interactivity of study content, which promotes a personalized approach to each individual student. For instance, a semantic networking (i.e. hypertextual flow of data) engages learners in a complete re-organization of their knowledge through the explicit interrelationship of study concepts. It also gives an opportunity for creating, manipulating and sharing the authentic data that leads towards larger and more accurate sets of information stored in cyberspace or specialized devices. Furthermore, modern computer applications are not only able to provide almost instant feedback and multiple-access to the course material from any networked computer, but also to deliver various types of virtual simulations prior to the real-world experience. This kind of interactivity, however, requires both the learner and the notional teacher to actively use the facilities and options provided, which is not always the case. Obviously, if there is no interaction there is also no communication. Means and Olson (1995) further argue that new media technologies, not only encourage students to take responsibility for their own learning, but also advance teachers' productivity. For example, computer-mediated communication (CMC) networks offer modern teachers a unique opportunity of accessing a *professional community*, where their expertise and experience can be shared with fellow colleagues, and where they can participate in professional discourse about improving practice (Corcoran, 1995).

Although the interest in new media technologies as an educational medium is constantly increasing, it should be noted that together with much strength, there are also numerous weaknesses of, for example, the most popular, to date, means

of knowledge transfer – the Internet. One of the biggest problems that presently exists and requires almost immediate solution is the deficiency of the Internet standards (e.g. data formats and protection, communications protocols), which undermines the very concept of e-learning. It has been established in this study that cyberspace is a constantly evolving phenomenon, which demands a continual update of information, because without it the whole concept of interactive cyber-education becomes meaningless. In order to illustrate some advantages and disadvantages of using this knowledge delivery platform for theoretical and practical study courses, I adapted the most relevant points from Forsyth (1998) and list them in Table 4 below.

TABLE 4: The Use of the Internet for Education Purposes. Adapted from Forsyth (1998)

Type of course	Strengths of the Internet	Weaknesses of the Internet
Mainly theory	Linking of information sources; Potential for developing meta-cognition; Opportunity for e-mail type communications; Possibility of chat and bulletin boards for information.	Potentially only screen-based information; Lack of defined audit trail; Problems with free text answers.
Mainly practice	Potential of computer-like patience in dealing with examples; Possibility of simulations; Drill and practice; Handling of structured assessment tasks; Bulletin boards for information; Possible sequential presentation of examples and demonstrations.	Various access tools (browsers) mean the fidelity of presentation may not be maintained, e.g. graphics audio and visuals may not be available to the learner if they have different computers. However, this should be a decreasing problem as cross-platform technology arrives.
General Considerations	Strengths of the Internet	Weaknesses of the Internet
	Individual and enterprise support; Ability to update course material; Capable of incorporating: Video Audio Still photos Text Information from other sources/sites.	Lack of standards (though <i>de facto</i> standards exist); Who has the skills and who does the updating on Internet material? How will your site handle the considerable demand on computer capacity required by the file sizes of video, images and audio (even with current compression technology)?

There is little doubt that as yet no technology fulfils all existing educational demands. However, it is quite obvious that the significant advantage of computer-based education, if used appropriately, is that technology supports and promotes exploration, independent inquiry and collaborative knowledge integration. As a result, it enables group thinking, problem solving, and task orientation.

### **3.1.1 Dimensions of the Learning Process**

There are several commonly recognized dimensions of the study process. This chapter focuses particularly on perceptions and attitudes that affect students' ability to learn, as well as on the integration and extension of their knowledge. Here, I argue that the key element of establishing a positive learning atmosphere in the classroom is giving students effective instructions and guiding their educational path, in relating new data to what they already know. There is a need to encourage students to rigorously analyze information they have gained, by applying reasoning processes such as comparing, classifying and abstracting, in order to organize, extend and refine new factual knowledge making it part of their long-term memory. As a result, the most effective learners develop the ability for critical analysis, creative thinking, and, consequently, are able to adjust their learning preferences.

The above dimensions function not only on the study side, but also influence the process of teaching, implying that delivery of knowledge should be well-structured and that study material needs to be approached in a consistent and systematic manner. This study argues that in this regard computer-based learning offers various benefits for the further interpretation of a subject of study, and, furthermore, for teacher-student interaction (in cases where students and teachers



are becoming equal partners). In the course of this research, it has been noted that the structured nature of computer-based materials gives learners a professional view of the content and the possibility to test and re-test their knowledge. Additionally, the ability to work on the course subject at a time convenient to the learner undoubtedly improves motivation and promotes positive attitudes to the whole educational process.

Denard (2004) points out that it is necessary for computer-based learning to be interdisciplinary, in order to intensify the cross-fertilization and exchange of study material. Furthermore, there is a greater need for computer-generated educational applications to be diverse in their format, providing various interactions and learning options. In teaching theatre history, for example, new technologies serve as an appropriate medium for a visually-enhanced communication of past theatrical events and artefacts. Indeed, cyberspace provides a great variety of scholarly materials, but also encourages their interactive exploration, by involving the students directly in the learning process. Another advantage here is that virtual study environments can engage their users (both imaginatively and intellectually) in a wide range of choices, options, and alternative ways of confronting and manipulating historical data. This kind of interaction extends beyond the scope of longer-established ways of learning. There is little doubt that the employment of innovative visualization techniques, such as virtual imaging or 3D simulations of numerous theatrical artefacts, combined with hypertext and other rich media resources, enhances learners' experiences and improves knowledge delivery. On the other hand, however, such digital reconstructions have to be supported by a vast array of explanatory information; otherwise it would be difficult to assemble them contextually.

Eversmann (2001) states that this sort of integration of multimedia function and VR modelling in the educational process dramatically increases the efficiency of learning by giving the learners an opportunity to interpret intellectually various destroyed or 'lost' theatre artefacts and places, in a way which was not possible in the past.

The possibility of employing virtual environments for teaching purposes in the area of theatre studies is very important for the practical component of my research. This innovative approach to learning not only reveals new dimensions in visual perception of knowledge, but also offers a potential for innovative experiments with such novel techniques as, for example, immersive VR and telepresence. Unfortunately, to date, these sophisticated applications cannot be delivered on the level of an open-access platform, mainly due to their prohibitive costs. Nevertheless, various software packages (e.g. 3D Studio Max and ArchiCAD) already allow learners to create, view, navigate, and explore interactively virtual models of historical theatre sites and stages. Furthermore, new avatar technology emerged as one of the most innovative e-learning techniques. An avatar or, in other words, a graphical personification of computer software processes, represents the next major wave in online communication and education techniques, dramatically enhancing the intuitiveness of navigation. This new technological reality involves a computational system that inhabits a complex, dynamic environment, where avatars act as a communication interface and provide active, personalized assistance to users, who are involved in collaboration with a particular computer application. These software agents (also known as autonomous software programs) are able to perform simulation of human activities.

An avatar has a built-in element of interactivity. It responds to the users’ requests and needs, it provides a clear, insightful, rapid link to an information database, and it does so in a manner that is easy to understand.

(Sheth, 2003, p. 2)

The avatars are able to learn the users’ preferences and interests, make suggestions, function with minimal supervision, and customize their assistance according to each participant. In Table 5, I provide a list of terms that relate to the autonomous agents technology (i.e. avatars). This is necessary for the reader to understand various modes of interaction through or with these virtual representatives, who could potentially be representations of future teachers in cyberspace. This table is adapted from Sheth (2003).

TABLE 5: Autonomous Agents Technology. Adapted from Sheth (2003)

Autonomous Agent	Description
Avatar	An image that represents a participant in a multi-user virtual reality space. An avatar may also represent the system or function of the system in an application. The avatar is a separate entity from the content it delivers, and usually requires support from an <i>infobot</i> or <i>chatbot</i> application in order to interact with users.
Bot	Autonomous software that operates as an agent for a user or a program, or autonomous software that simulates a human activity. From ‘robot.’
Chatbot	A bot that is able to interact with humans in a conversation. A chatbot maybe a complete Artificial Intelligence (AI) implementation or it may be an interface only. Chatbots generally manifest as text only, although a few also have avatars.
Infobot	A bot that delivers content from a common database of information for users on a chat system. Infobots may often have a simple chatbot interface, to allow them to respond to key phrases, as well as to direct inquiries.

Some of the aforementioned autonomous agent technologies have already been employed as educational applications, but without being adopted yet for mass-



market production. This study shares Sheth's (2003) belief that the main cause of such poor usage is the failure of the e-learning interface designers to familiarize themselves with the benefits that avatars can offer to the whole computer-based knowledge delivery. There is little doubt that the lack of interest in such innovative technology affects the acceptance of avatars as a learning tool, also meaning that, to date, a balance between technologies, which could potentially be used for educational purposes and to enhance the technological awareness of designers, teachers, and also students, has not yet been established.

### **3.2 Computer-Based Projects in Theatre Education and Practice: A Critical Overview**

There is a range of software- and online-based projects that offer a unique opportunity to experience new forms of theatre, entertainment, and culture through an amalgamation of virtual reality, installation and performance. Some of them aim to provide new user-friendly ways of accessing media databases of our cultural heritage and build upon traditional research and teaching methods. Others employ VR techniques to expand the definition of traditional performance space, sometimes suggesting certain ways and contexts to replace the embodied sites with virtual ones, in order to introduce learners to the spatial and mechanical aspects of theatrical space. Additionally, such projects aim to evoke new associations, meanings and values that could fundamentally reshape the conventional construction of theatrical and art venues. These endeavors tend to reflect critically on the relationship between digital technologies and the design of contemporary software interfaces, often, in order to achieve better theoretical and practical outcomes and to promote independent and user-centered learning.

Furthermore, some of the existing projects tend to bring together into productive liaison different models of study (as in the field of theatre history), while also suggesting a wide range of innovative applications to related subject areas. The questions that need to be asked, however, are whether these projects are effective in terms of educational and professional development and what kind of limitations affect such an approach to knowledge delivery and creativity training?

Further in this chapter, I will provide a critical overview of new types of digital performances, which offer a new quality of theatrical experience and reorganize cultural material, in order to deliver it interactively. I will design the evaluation framework for software packages by critical examination and assessment of two computer-based projects (specially produced for theatre students, researchers and designers), that, in the context of this thesis, I distinguish as three dimensional reconstructions (Case Study One) and IT tool for theatre-creation (Case Study Two).

The first case study explores 3D modelling methods for the digital recreation of historical architectural sites and performance spaces, which were effectively lost after the demolition of the original buildings or after theatrical events had taken place. In this part of my thesis, I focus on the THEATRON project – Theatre History in Europe: Architectural and Textual Resources Online – that concentrates on the evolution of a performance space and specifically its architecture.

In the second case study, I examine an existing free-downloadable software package – the *Visual Assistant* (VA), – which was specially created for trainee set designers. It combines the conventional theatrical models with VR technologies for producing accurate 3D sketches, in order to support creative

thinking, and to explore the boundaries of how two-dimensional images can be manipulated within three-dimensional space.

Finally, I analyze the outcomes of the online questionnaire, which was conducted with the principle creators of the two projects, in order to give them an opportunity to assess their own work. The full version of it is provided in Appendix Three of this thesis.

### **3.2.1 Interactive Installations, Performances and Storytelling**

Since the 1990s, one of the main purposes of computer-based information space has been to explore how new forms of art, performance, entertainment and overall culture can be experienced within mixed-reality spatial environments, where participants can interact with computer-generated artefacts in an integrated way. A number of VR-based projects investigate various inhabited digital spaces and are involved in experiments on mixed reality and the understanding of social interactions. Furthermore, they concentrate on the integration of artistic, technical and social perspectives, which can result in highly engaging multi-user interfaces, which would serve to provide innovative forms of communication between the participants. In addition, these projects emphasize research on the new boundaries between real and virtual spaces. The eRENA (Electronic Arenas for Culture, Art, Performance and Entertainment) project, which is run by academic institutions in Germany, Sweden, Switzerland and England, as well as major corporate partners and a commercial SME, would be a good example here. It aims to bridge the gap between contemporary small-scale, real-time communication technologies, such as video conferencing and current massive-scale non-participative broadcast techniques. In perspective, the project intends to publicly demonstrate and



evaluate the results of its findings through thematic spaces, initially based on the extension of the traditional cultural forms of galleries, performances and television. This is relevant to this study, because such types of interactive performances attempt to problematize the boundary between the 'existing' and the 'imaginary' and bring the participants to a new understanding of how two realities are blurred. The project proposed to locate its users in a collaborative virtual environment, where 'real' reality integrates into 'virtual' and vice versa. The main goal of this offered performative experience is to explain how mass media can distort the appraisal of the world beyond one's personal perceptions, by providing a setting for individual and social interactions in VR and theatrical spaces (eRENA report, D7b.3, 2000). This project presents interactive performance as a game, an installation, or an electronic 'arena' with a technical infrastructure that consists of such technologies as a distributed VR and projection environments, a user interface, audio monitoring, feedback, and a card activated video replay.

The *Desert Rain* project is another example of participatory experience that pushes VR technology beyond its supposed limits. It is a result of collaboration between the Blast Theory group and the Mixed Reality Lab, University of Nottingham and is an example of significant work in the area of performance art and new media:

The piece is influenced by Jean Baudrillard's assertion that the Gulf War did not take place because it was in fact a virtual event. Whilst remaining deeply suspicious of this kind of theoretical position Blast Theory recognize that this idea touches upon a crucial shift in our perception and understanding of the world around us. It asserts that the role of the media, advertising and of the entertainment industries in the presentation of events is casually misleading at best and perniciously deceptive at worst. ... While these ideas form the backdrop to *Desert Rain* the piece is not intended to be a demonstration of this theory merely to accept its significance in informing our view of the relationship of the



real to the virtual and especially in its assertion that the virtual has a daily presence in our lives.

(Desert Rain, Conceptual Background

Available: [http://www.blasttheory.co.uk/bt/work\\_desertrain.html](http://www.blasttheory.co.uk/bt/work_desertrain.html))

The participants in this project are placed in a collaborative VR environment with virtual scenery projected onto the rain curtains (Fig. 3), for the purpose of exploring a number of landscapes and experiencing various types of media including live audio and video links to other players. The main outcome of the *Desert Rain* installation can be described as a new form of storytelling between interacting audience members that, in a productive way, challenges traditional ideas of narrative by confusing conventional understandings of who is a performer and who is a viewer (Shaw, 2000).

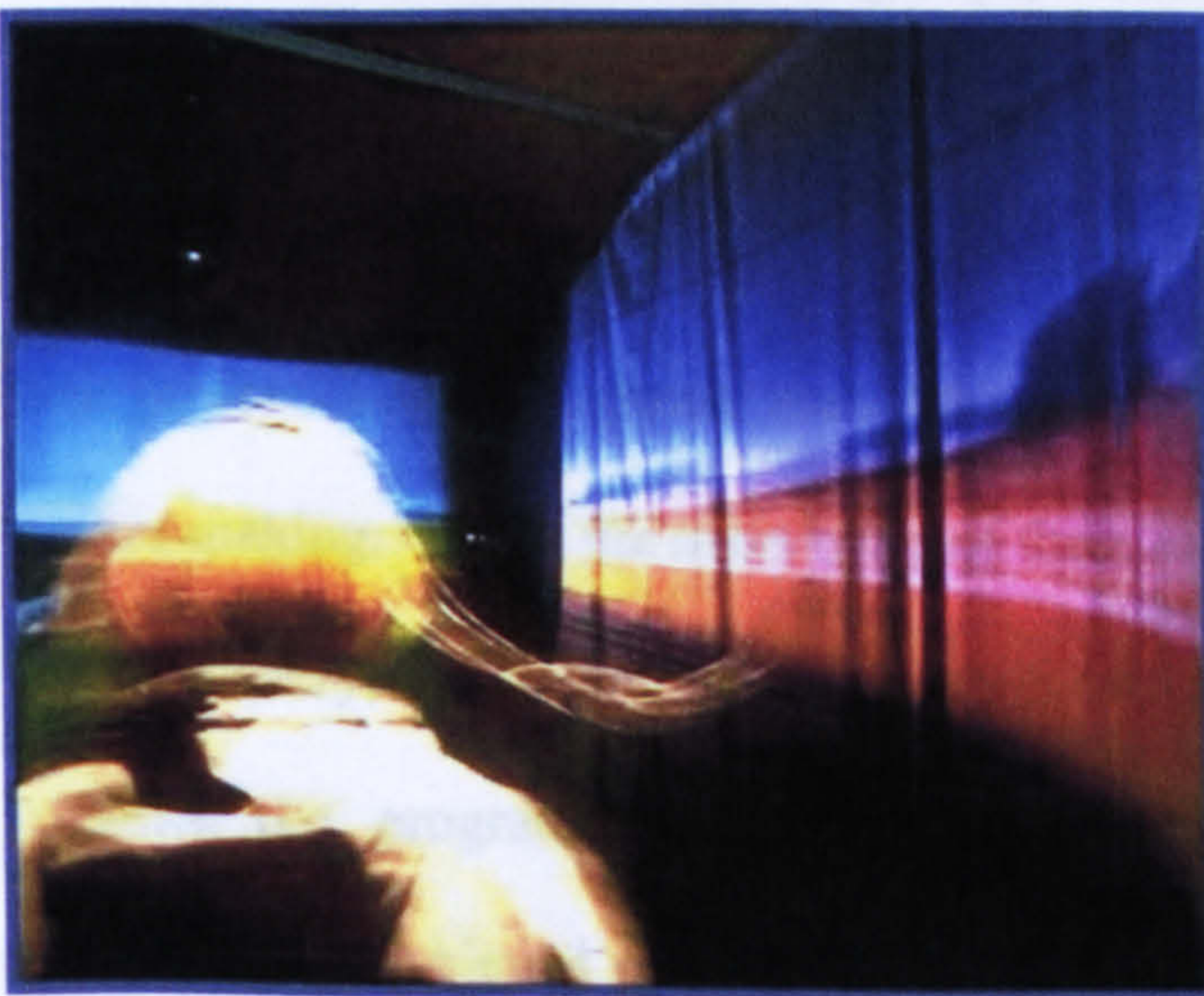


FIGURE 3: *Desert Rain* Installation. Source: <http://www.arena.kth.se/desert.html>

A number of computer-based projects aim to develop a prototype of a generic platform for interactive performances and storytelling within mixed reality worlds. While analyzing these kinds of applications, it is particularly important to concentrate on the notion of their flexibility to be installed in different environments, such as e-learning spaces, museums, information points and



situational training facilities. Nevertheless, to fulfill users' entertainment and educational demands fully, all technical specifications of these platforms (e.g. interactivity, virtual characters, animation, rendering applications containing graphics and sounds, device management, gesture recognition for tracking hand movements and 3D scanning) must be carefully designed and integrated within the appropriate learning environment, but also audience research (i.e. the intended users' needs and aspirations) should be undertaken before the actual implementation of the project. The pilot testing of any technology-mediated project is also crucial, especially for revealing possible technological (e.g. systems compatibility) and motivational (e.g. unclear content and instructions for use) failures.

There are several research groups, whose goal is to install a number of basic application scenarios for students to develop during a course, but which can also serve as study means for theatre artists, directors, and designers to benefit their professional development and lifelong learning, as well as to promote digital theatre-making. One of the main goals of these experimental practices is to design digital scenery, which is unique to every theatrical piece and could be constantly modified (i.e. programmed) during the performance. Such mobility in the set design can be achieved only if it is not pre-recorded or limited to the physical confines of a particular theatre space, but can be manipulated in real-time with the purpose of ensuring uninterrupted interaction with digital environments during the live performance. For example, the researchers in the Institute for the Exploration of Virtual Realities (IEVR) within the University Theatre and the Department of Theatre & Film at the University of Kansas conducted several experiments with stereoscopic projections, VR headsets and live web-casting, aiming to investigate



how digital technologies and the Internet can be incorporated into live theatre productions. Some of these experiments enabled specially designed virtual sets to be projected directly on stage and, conversely, to visualize the actors in VR environments, by using video and chroma key (i.e. superimposing one video image onto another) technologies. In addition to this, the research group examined the possibilities of communicating live performance to distant audiences and, furthermore, to stage real-time theatre shows in cyberspace, hoping to deliver live acting into ordinary homes.

The Institute for the Exploration of Virtual Realities produced and staged a number of theatrical pieces, such as *The Adding Machine*, *Dinosaurs*, *A Midsummer Night's Dream* (which was a collaboration between the Kent Interactive Digital Design Studio (KiDDS) and Mark Reaney from the IEVR) and *The Magic Flute*. The ultimate goal of each performance was not only to generate and operate from the backstage such scenic elements as virtual landscapes and characters (Fig. 4), but also to justify the use-value of these multi-layered media settings in presenting a theatre show to a real audience. Mark Reaney, a designer and technologist of the research group, wrote about the performance of *The Magic Flute* at the University Theatre, University of Kansas in April, 2003:

In order to stretch the technology to create hybrid performer/creatures, we will need to experiment with new techniques of projection. In each of our previous experimental productions our main objective was to create virtual settings and therefore we relied on a fairly standard arrangement of rectangular rear-projection screens. To create *The Magic Flute's* characters, we will need projection surfaces that can move with the performers and be manipulated by them. Digital images will be projected onto special designed costumes, props and masks. In turn, the digital projectors will need to be mobile rather than fixed.

(Mark Reaney, 2003

Available: <http://www.ku.edu/~mreaney/flute/>)





FIGURE 4: The scene from *The Magic Flute* production at the University of Kansas' University Theatre. Source: <http://www.ku.edu/~mreaney/flute/>

There is little doubt that the possibilities of implementing various computation technologies to enhance existing theatrical spaces are vast. It should be noted, however, that there have not yet been many attempts made by the scholars and creative practitioners to invest in what could potentially be a new form of theatre performance. There are claims made by the creators of the virtual avatars' habitats that it is already an established performance space. The key problem with these assumptions is that, at least to date, this type of VR environment still looks like a complicated interactive computer game – not like a space for experiencing theatre. Therefore, more research on this topic needs to be undertaken before the association between the avatars' worlds and theatre venues is more clearly understood.

### 3.3 Evaluating Educational Software

Nowadays, there is a wide range of educational software available for teaching and learning purposes in various fields of knowledge, including theatre studies. These packages, however, are not of equal quality and may only partially fulfil the educational needs of students, without satisfying all of them. It is very important to distinguish what is appropriate for a particular study module, meaning that each piece of educational software should be designed to deliver a particular learning



experience. Most software packages do not neatly fall into just one category, but could be easily classified under several. Unfortunately, drama and performance studies are still relatively unexplored territory, in terms of the use of computer programs, specifically designed for teaching purposes. Therefore, there is a need for theatre educators to become more knowledgeable about the various types of available educational packages and their significant features, in order to make full use of them in the classroom, and possibly to design their own.

Theatre education has always balanced between the demands of theory and practice. Traditionally, the visualization of the evolution of performance space, its scenery, costumes and, certainly, specific aspects of its technological development, was complicated. There is a range of computer software for teaching theoretical and practical elements of theatre which, if used properly, can strongly influence the overall quality of the educational process and learning outcomes. These software packages serve numerous course objectives and can be characterized as computer programs for supporting e-learning applications and for designing theatrical spaces and sets in 3D (Fig. 5).

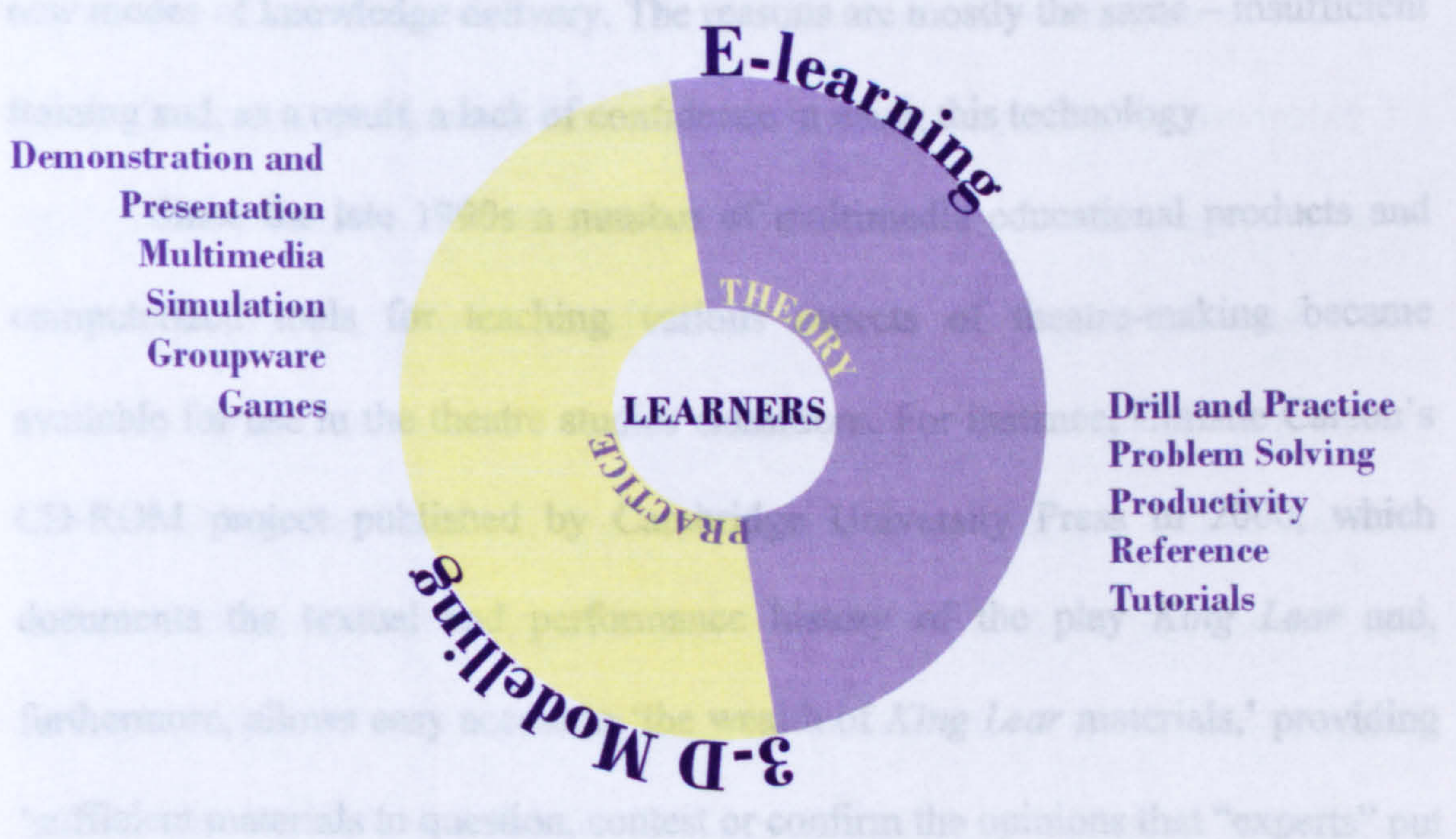


FIGURE 5: Characteristics of Computer-Based Learning in Theatre Studies. Author: Iryna Kuksa



It should be noted that Figure 5 represents only two aspects of computer-based theatre education (e-learning and 3D modelling), which are the most important for the present thesis. There are, obviously, many other applications that stretch the boundaries of the established theatre classroom, such as the use of motion-capture technology, to create VR performances or the use of telepresence techniques, which provide a personalized approach to long-distance learning. Furthermore, interactive whiteboards (IWB) – the electronic equivalent of chalk and blackboard between remote users – have become available to study, evaluate and analyze the recorded live performances. Obviously, there are numerous advantages of implementing this innovative technology for studying the performing arts. For instance, the ability to use various computer applications (e.g. Microsoft PowerPoint, Excel, Word, AutoCAD) and even digital projections on the IWBs allows making real-time changes directly on the interactive whiteboard, saving files with notes, converting handwriting to text, and writing in digital ink over applications, websites and videos. On the other hand, however, teachers are hesitant about changing their pedagogical methods, in order to incorporate these new modes of knowledge delivery. The reasons are mostly the same – insufficient training and, as a result, a lack of confidence in using this technology.

Since the late 1990s a number of multimedia educational products and computerized tools for teaching various aspects of theatre-making became available for use in the theatre studies classroom. For instance, Christie Carson's CD-ROM project published by Cambridge University Press in 2000, which documents the textual and performance history of the play *King Lear* and, furthermore, allows easy access to 'the wealth of *King Lear* materials,' providing 'sufficient materials to question, contest or confirm the opinions that "experts" put

forward' (Carson, 1999, p. 434). Another example is *A Shakespeare Suite* project, which contains both an extensive library (a collection of texts, music and video files, which were not intended to be a critical analysis of Shakespeare's work, but a comprehensive information resource) and a virtual stage – *Scenario* – which is a simple piece of software, featuring a 2D reconstruction of the inside of the Globe theatre. This 'virtual theatre' can transform the users of the package into the directors of one of three pre-programmed Shakespeare's plays, providing them with the choice of actors in a variety of poses and also props, which can be superimposed and manipulated on the virtual stage. This software also allows the users to create 'a series of "frames", each of which follows on from the previous one, and each of which can be enriched with a sound effect if appropriate' (Steggle 2003).

The above projects are good examples of the development of the CD-ROM format for educational purposes in the area of theatre history. This study, however, is concerned with the field of scenography and theatre design, where most educational software is limited to two types. The first one exists in the format of a database and contains mostly reference materials, such as historical facts, photographs, videos and even technologically sophisticated navigable 3D models of theatre sites. The second type gives its users a unique opportunity to be creative and design, for example, theatrical scenery, lighting, or costumes. These computer programs do not usually include any supporting or explanatory information on the historical features of various set designs, which therefore makes them purely technical. Unfortunately, neither of these types of software packages, despite their innate usefulness, are widely used. Later in this chapter, I will attempt to find the reasons for this through applying a case study approach.

### **3.3.1 Criteria of Software Evaluation**

In order to analyze the existing software packages for theatre education and practice, there is a need to create a manageable set of evaluation criteria, which in turn can elicit the users' requirements. Obviously, there are many issues here to consider: for example, evidence of software effectiveness; alignment with HE institutions or individual learners' standards; suitability for users' needs and learning styles; and certainly the total cost of purchasing, maintaining, and upgrading the necessary hardware and software. In the context of this study, I distinguish and particularly focus on such evaluation criteria of computer-based projects as the learners' profile and learning environment, program content, technical aspects, and documentation. These criteria are necessary, in order to familiarize the intended users of the educational software packages with their unique and common characteristics, as well as to provide students with their preferable learning style. They are also essential for outlining in what context the learning activity is to occur (e.g. its timeframe, format, content and instructional goals). Furthermore, such aspects as the accuracy, currency and balanced presentation of information, logical progression of topics, variety of activities with options for increasing complexity, and stereotype-free content are also very important, in order that educational software packages might succeed. Other significant facets to be considered before implementation of the computer-based learning product may include the description of specific hardware requirements for operating the application, supplementary materials on the enrichment of learning activities integrated into the curriculum, and a teacher's guide, describing the target audience and containing suggestions for classroom use, lesson plans, related exercises, and a summary of the content. Finally, various technical and



presentational attributes of any study software also play an important role in the process of interactive computer-based learning. Intuitive navigation, rapid retrieval of information and screen transitions, as well as record-keeping features serve to benefit and monitor the project users’ progress.

Indeed, the overall effectiveness of any computer programs depends on the way information is presented. If the content develops in a logical way, it will stimulate the users’ imagination and curiosity and provide necessary opportunities for creative problem solving and the accomplishment of the course objectives. The majority of educational software, however, still requires further development work. Thus one of the purposes of the current study is to provide an evaluation framework (Table 6) for computer-based educational projects, which would help to assess their efficiency for intended users.

TABLE 6: Case Studies Evaluation. Author: Iryna Kuksa

Criteria		Project Objectives	Evaluation
Learners’ Profile	Characteristics: Learning Style:		
Learning Environment	Format: Instructional Goals:		
Program Content	Accuracy: Currency: Activity:		
Technical Aspects	Presentation: Navigation: Quality:		
Documentation	Guides: Materials:		
Effectiveness:			

3.4 Case Study One: 3D-Reconstructions – the THEATRON Project

The practice of applying emerging multimedia technologies, including the potential of 3D modeling, for educational purposes is uncommon in the field of theatre studies. The reasons are varied: they include both students’ and teachers’



lack of technological knowledge and experience, complicated-in-use software packages, dated computer equipment, to name a few. The THEATRON project was amongst the first examples of how VR technologies could be employed as teaching means in theatre education. It emerged as a specific computer-generated tool that made it possible to discover, investigate and analyze visual dimensions of theatre history (Fig. 6). The abbreviation *THEATRON* decodes as Theatre History in Europe: Architectural and Textual Resources Online. The project was conceived by Professor Richard Beacham of the School of Theatre Studies at the University of Warwick, and Dr. Peter Eversmann of the Department of Theatre Studies at the University of Amsterdam in 1998.



FIGURE 6: The THEATRON Application. Source: [www.theatron.org](http://www.theatron.org)

The idea behind the THEATRON online module was not only interesting and innovative, but also quite challenging for established teaching techniques in theatre education. The project aimed to enable its users to experience ‘virtually’ the evolution of the European theatre and provided a well-grounded understanding of the elements of architectural space and also time in 3D.

### 3.4.1 The THEATRON Project’s Objectives

The THEATRON project drew upon currently best pedagogical practice and provided a customized user interface, to enable collaborative learning and



knowledge delivery. The original idea of the application was based on the ‘virtual’ reconstructions of historically significant theatrical sites in Europe. The content of the module was presented in the shape of navigable 3D models of fifteen key European theatres and stages. The THEATRON Report dated 2001 states that such an advanced VR approach attempted to present available visual information, in as vivid a way as possible, through enabling the potential users to access a wide range of imagery (e.g. sketches, photographs, video footage, and animations) and interact with the 3D architectural environments, which were supposed to be ‘highly instrumental in shaping the synthesis of all the theatrical elements, and in determining the experience of the performers and their audience’ (p. 3). Furthermore, it was also planned to use acoustical applications for reproducing the ‘attributes of spaces and permit a straightforward comparison of the acoustical conditions found in different theatres under specified conditions’ (p. 6). The creators of the project identified its three main advantages as follows: (1) presenting 3D reconstructions within appropriate social and urban contexts and cross-referencing them to the supporting printed publications; (2) providing an important stimulus to learning by maintaining a high level of architectural and archaeological accuracy; and, finally, (3) employing readily accessible hardware and software for delivering the project’s content, to ensure its maximum use in academic environments. A further advantage of using the application was the possibility for geographically separated students and teachers to access the THEATRON resources simultaneously. It should be noted that this online module was intended as a type of educational virtual theme park, where its users could visit individual theatres from different historical periods and, at the same time, obtain an important understanding of the genealogical-tree of the theatres in

Europe (i.e. the way they evolved and were influenced by various cultures), and also question the reconstructions using the contextualization of the 3D models with primary source materials.

In order to illustrate the educational impact of the THEATRON multimedia module on the theatre studies classroom, I will attempt to provide a comprehensive evaluation, based partly on various surveys and testing (the materials, which were kindly provided for my critical assessment by the THEATRON team), but mainly on the conclusions drawn from my own interaction with the application, informal interviews conducted with some members of the project team, and a questionnaire, which was specifically composed to obtain Professor Richard Beacham's personal evaluation of the THEATRON project. More detailed information about the actual testing of the project can be found in Appendix Four of this thesis.

### **3.4.2 Evaluation**

There is little doubt that the THEATRON module aimed to combine educational, technological, preservation and entertainment applications for enhancing the process of teaching European theatre history at university level. The project proposed to combine VR technologies with existing research and teaching techniques, by applying a learner-centered approach. The crucial component of the THEATRON application is a range of VR models of selected historical theatres, which the users of the project are able to explore interactively, simultaneously viewing 2D depictions that illustrate the structural components of theatre buildings, pictures of the present sites and reports on archaeological digs. The content of the THEATRON module consists of two main divisions: (1)



general information, which is essentially the same for each of the theatres (e.g. historical description, maps, present condition of the site, bibliographies, related websites, examples of research topics and assignments for papers), and (2) specific facts that are related to a particular theatrical site and its special features (e.g. various viewpoints and video files). Furthermore, the selection of the module's research materials can be divided into primary (letters, critical descriptions, architectural texts, sketches, drawings and paintings) and secondary (scholarly texts and commentaries, previous drawings and depictions of the site) sources, which helps the module's users to analyze each theatrical construction, in terms of historical and visual references. There is also a common point of reference (a man's figure), which serves to help the learners with determining the real size of the objects represented in the model and obtaining the right impression of the building's size.

Initially, the THEATRON project was created as an online resource with the possibility of being linked to a CD-ROM, which was supposed to give the users a more flexible approach to self-learning without the necessity of being constantly connected to the Internet. It was decided, however, that the application should be a 'living' resource, which is impossible to achieve in a fixed CD-ROM version. Furthermore, the funding body of the THEATRON (the European Commission (EC)) required the employment of only innovative technologies for this application, which, at that time, was the WWW. As a result, the module was designed in an adaptable manner that allowed its continuous update, reflecting emerging 3D rendering techniques, which could be potentially used for navigation through the virtual models in real time. The flexibility of the project's structure was also necessary for producing new ways to conceptualize and implement

growing digital research applications constantly. The 3D theatre sites were designed with the ability to grow quantitatively and to be constantly updated, modified and improved, in order to enhance the THEATRON module's functionality. Difficulties arose, however, when the appropriate funding to maintain this continuous upgrade of the module was not obtained. At present, there are approximately five other sub-modules that theoretically could be integrated into the body of the main database, but the unwillingness of the funding bodies to underwrite made it impossible to achieve.

The THEATRON project aimed to promote an innovative technical approach to knowledge delivery, which is essentially *cross-platform*. It introduced new skills, methodologies, and modes of communication. The pedagogical value of the module was that it enabled an *experience* of the presented theatrical sites, as the opposite to an *abstract* or a *described* phenomenon. The THEATRON operated with what were then relatively new forms of textuality, such as hyperlinked structures and user-interfaces that empowered different ways of producing and delivering knowledge (Denard, 2004). It should be noted, however, that these visual and educational innovations were not implemented completely in the theatre studies classroom, largely due to the insufficient funding, which caused many technical problems in running the application and, consequently, low interest. For example, the system requirements for operating the THEATRON module clearly state that, in order to access the architectural features of a venue by navigating through the 3D model, it is necessary to have CosmoPlayer, Version 2.1.1 installed. While conducting evaluation of the module, I discovered that this software is no longer produced nor supported by the manufacturers. It has been superseded by a new package called Xj3D which, unfortunately, was not



compatible with the THEATRON format. In order to operate 3D models, I had to download another program (Cortona), which was briefly referred to in the THEATRON help files. The aforementioned indicates clearly that neither students nor teaching or research staff of the School of Theatre and Performance Studies at the University of Warwick had reported this failure, meaning that their interest in using this free application, as a study means, was notably low.

When I was finally granted access to the THEATRON content, I found some other inconsistencies, which affected the project's structure and overall quality of presentation. One major criticism is that the 3D models lack texturing and are often not embedded within an appropriate social and urban context (as was promised in the project's rationale), representing only a visual indication of the space without any particular geographical features. The module might have been more interesting and useful, if it had included the possibility of viewing the presented theatre sites at various stages of their historical evolution and, furthermore, if it had contained 3D reconstructions of theatres from outside Europe. Another drawback of this application is that the intention of the creators to have a 'stripped down' version of the THEATRON (i.e. to provide different levels of complexity within the module content), in order to serve the needs of different user-groups, has never been accomplished. Additionally, a user-forum, which was supposed to provide a useful repository for present and future subscribers, as well as serve as a means of feedback for the development team on how the application was functioning, has never been integrated into the body of the module. It was also suggested in the project's intended outcomes that while interacting with the THEATRON module, its users would be able to compile personal notes and visual data with the possibility of saving them, printing them

out, viewing them independently, and using them for the creation of various presentations. Although, all the resources in the module are web-delivered and anyone with a basic knowledge of the WWW could potentially save the THEATRON materials for their personal use, this potentially useful feature has never been developed. Finally, special CD *Resource Packs*, which were envisioned in the module's rationale for distribution amongst lecturers, aiming to help them to develop various 'teaching-with-THEATRON' strategies, have never been produced. After careful investigation, this study concluded that the majority of the aforementioned ideas did not materialize in reality mainly as a result of insufficient funding, which also led to the failure of disseminating the module to a wider network of users.

It should be noted, however, that there were some other shortcomings of the THEATRON module (e.g. in the interface design and navigation quality), which negatively affected the process of interaction with the application in its existing state. For example, the location of the navigation buttons, which were supposed to take the learner to important study information (e.g. academic references, maps and plans, animations of the interior and exterior) was not obvious, meaning that the user had to make a conscious effort to find them, which could have caused a loss of interest in further interaction with the module's materials. Another problem occurred with a *demo* version of the THEATRON application (available on [www.theatron.org](http://www.theatron.org) for a trial); it did not function, making it impossible for potential subscribers to get acquainted with the project. These drawbacks could have been easily fixed, if only a final phase of the module's evaluation and validation (the importance of which was clearly stated in the project proposal) had been performed. Unfortunately, the funding body did not



require an extensive survey of how well the THEATRON project functioned as a learning tool and, as a result, no evaluative feedback on the module has been cited since spring 2004.

I conducted an online questionnaire with Professor Richard Beacham, a principle creator of the THEATRON module, asking for his personal evaluation of the project's outcomes, aiming to investigate whether, in his opinion, this innovative approach to learning changed the way we perceive theatre history. Professor Beacham was convinced that the THEATRON fulfilled fully, and in some cases even exceeded, the suggested programme of work, which was also acknowledged by the EU appointed team of inspectors. He admitted that the biggest challenge while creating the THEATRON database was resourcing. The lack of it prevented the feature of virtual acoustics from being integrated in all theatre models presented in the module. Professor Beacham expressed a strong opinion that: 'it [THEATRON] definitely has influenced how we perceive and create theatrical worlds (and their scholarly and pedagogical investigation), through its capacity to evoke virtually, the constituent theatrical expressive elements of movement, space, time, and visualization.' However, he also mentioned, that 'in retrospect, it might have been better to propose a more modest programme of work.' The full version of this questionnaire is provided in Appendix Three of the dissertation.

In Table 7, I provide a summary of my assessment of the THEATRON module, outlining its overall effectiveness.

TABLE 7: The THEATRON Project Evaluation. Author: Iryna Kuksa

Criteria		Project Objectives	Evaluation
Learners' Profile	Characteristics:  Learning Style:	Theatre Studies, Architecture, Scene and Costume Design students /scholars.  Self-centred and group learning.	Mostly theatre studies students/scholars are using the application. However, even amongst them the motivation to interact with the module is low.
Learning Environment	Format:  Instructional Goals:	Independent and in the classroom.  Direct experience and analysis of historical theatre sites.	The module enhances all types of learning and also improves research and problem-solving skills. The pedagogical value of the THEATRON project is that it enables 3D visualization of historical theatre sites. The presentation of the study material encourages users to develop further interest in the subject. However, the opportunity for co-creation has not been provided (developed).
Program Content	Accuracy:  Currency:  Activity:	Contextualized 3D models, Maps & Plans, Historical Description and Present Sites.  Online-based multimedia module.  Tasks, Questions and Suggested Research category; Email, Bookmark, Search.	The interaction with the module enables a better understanding of the presented architectural environments. The THEATRON content has the possibility for constant update and is able to grow quantitatively (i.e. new sites and materials can be added, buildings' architecture can be modified and improved, and the module's functionality can also be enhanced). The application contains some examples of research topics and assignments for papers, which are very useful for scholarly research. However, some intended feedback and interactive features (e.g. the user forum, personal notes production, etc.) were not integrated in the body of the module.



Technical Aspects	<p><b>Presentation:</b></p> <p><b>Navigation:</b></p> <p><b>Quality:</b></p>	<p>Media Links – Video, Audio, Text, Picture, Animation/Movie icons.</p> <p>Dynamic Window Panels: with general or viewpoint information, virtual walkthroughs.</p> <p>Updated 3D rendering techniques.</p>	<p>With present technological development there are no difficulties in rapid retrieval of information and screen transitions, while using the THEATRON. The module provides a number of intuitive icons, menus, and directional symbols that foster independent use. It also contains controllable animation and sound, including stop/pause/exit options. However, the application can no longer be operated using the CosmoPlayer platform due to the termination of its production. And also, the 3D models only serve as visual indicators without any integration within geographical settings.</p>
Documentation	<p><b>Guides:</b></p> <p><b>Materials:</b></p>	<p>CosmoPlayer tutorial; Help function; Search; General THEATRON Information, Customer Support Email.</p> <p>Glossary; References; Related Websites, Bibliography.</p>	<p>The module contains a number of categories with detailed information on the selected theatre venues, links to related academic resources, and also general description of the application and customer support feature. However, the intended special ‘resource packs’ envisioned on CDs, in order to be purchased by the lecturers and teachers (the THEATRON users) have not been produced.</p>
<b>Effectiveness:</b>	<p>The THEATRON module offers a unique visual approach to teaching theatre history at HE institutions. It combines innovative VR technologies with established educational techniques. Module information is presented in a developmentally appropriate and logical way, and in a manner to stimulate students’ imagination and curiosity. However, lack of funding, evaluation and promotion techniques undermined the idea of a ‘living’ (i.e. constantly updated) module, caused low motivation in the users (both teachers and students), and also limited possibilities of scholar-application interaction (i.e. students are only consumers of a digital resource).</p>		

To date, the project is considered accomplished with the released version available on [www.vitruvius.ac.uk](http://www.vitruvius.ac.uk) for the University of Warwick users. Unfortunately, in October 2006 it was discovered that the module can no longer

be accessed by the Warwick students, due to poor maintenance of the server. It should be noted, however, that the THEATRON team (now based at the King's Visualization Lab at the Centre for Computing in the Humanities, King's College London) expressed a clear intention to 'revive' the module in the near future in the form of web-based freeware, making it available for scholarly use, free of charge.

### **3.5 Case Study Two: IT Tools for Theatre-Creation – The Visual Assistant**

'Software designers are now facing a dilemma as users adopt an increasingly creative role. As designers they must accept responsibility for the use of their software (it is not acceptable to excuse themselves by claiming their software was used "improperly") yet they must delegate some responsibility for its meaning to the users. This is a major ethical issue in the design of virtual environments. The design of the VA has, I hope, begun to open up some of the issues involved in this dilemma, but there is still some way to go before our understanding is commensurate with the task before us.'

Beardon (2001) Available: <http://www.cultivate-int.org/issue5/creative/>

One of most important developments in Western theatre is the transformation in our understanding of the role of a theatre designer. Since the late nineteenth century, design pioneers such as Adolphe Appia, Gordon Craig, and Norman Bel Geddes experimented with visual technologies, aiming to enrich theatrical performances through demonstrating the possibilities of design beyond decoration (this issue will be explored in the following chapter). Traditionally, theatre designers construct 3D models of the stage and scenery, in order to visualize future performances in detail. They also try to enhance the conception of production design, by employing the elements of time and movement even during the sketching process. When new digital technologies became available, there were numerous efforts to generate various types of computer software that could



represent flexible 3D spaces, which were supposed to echo real theatrical environments. A number of software designers attempted to organize this computer-generated work place specifically for theatre-makers. It should be noted, however, that there is a big difference between software and production designers' attitudes towards computer programs, which are produced to support creative practices. Stage and industrial product designers typically refuse to engage in constructive criticism, or to accept any responsibility to improve upon a piece of software, or even to make an effort to understand it. Beardon (1999) points out that this refusal is indeed a surprising connotation of the concept of 'computer as a tool' within creative practice. There are a number of 'contrary users' (usually industrial, graphic and stage designers) of creative computer programs.

They ['contrary users'] will often say that they only got interesting results from software once something went wrong. Some elevate this to a technique, forcing the software to misbehave or deliberately subverting the intentions of the software designer in order to get an interesting response. Though this is anecdotal, I am surprised just how many times I have heard the chance remark that progress was only made when software did something unexpected.

(Beardon, 1999)

Available: <http://www.cs.waikato.ac.nz/~cbeardon/papers/paper9902.html>

There is little doubt that a better understanding of theatre and software design traditions can only be determined through user-software interaction. Thus, to avoid the 'contrary use' of the creative software packages, there is a need for their constant evaluation and assessment, in order to provide solutions to existing problems, instead of simply being a tool that might only help to solve it (Beardon and Enright, 1999, p. 5).

Professor Colin Beardon presented his project The Visual Assistant (VA)



(Fig. 7) as an ‘injection’ of scenographic thinking and visualization that should be judged only by the improvement it makes in the creative process, rather than by the quality of its own outputs. He argues that the VA recognizes the difference between inventive and technical practice and supports such creative processes as sketching and collage, which enables its users to experiment with new images and objects and also to re-employ already existing material, in order to transform its context of meaning.

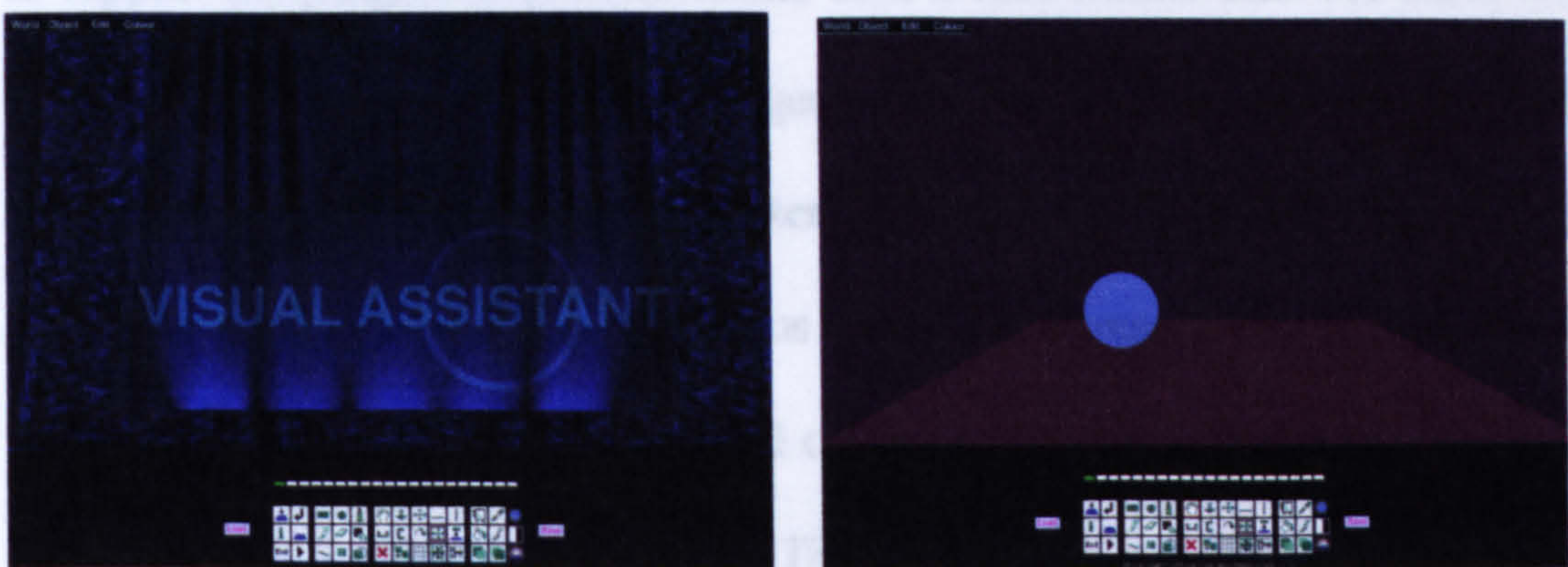


FIGURE 7: The VA Software. Source: <http://www.cs.waikato.ac.nz/~cbeardon/>

### 3.5.1 The Visual Assistant Project's Objectives

The Visual Assistant was described by its creator as a piece of software, designed specifically for theatre use, but with much broader potential application. The product became first available in May 1997 and was envisaged as part of a multimedia tool kit, which was supposed to consist of the Writer's Assistant and the Director's Assistant (training packages for script writing and directing), the Producer's Assistant (to assist in planning for a production), and, finally, the Visual Assistant (for preliminary visualisation of a future performance). The project attempted to implement and test new purpose-built software applications created for specific users and areas of use, aiming to introduce learners to the processes of designing for theatre. The VA is a compact (around 500K on disk)



package available to download free of charge from its official website (<http://www.cs.waikato.ac.nz/~cbeardon/VA/index.html>). It served to provide an extension of sketching techniques for creating theatre sets within computer-generated environments, through the combination of both 2D and 3D representations. The software was designed to act as a new 'code' for visualizing theatrical space, which is simple to use and also sufficiently sophisticated for employment by professional theatre practitioners. The idea of the VA project was to support the process of creation rather than a final result. The VA users were provided with various objects and images, which can be arranged in a simple 3D space. For example, such historical materials as scanned images of stage settings, standard props or photographs of famous actors and actresses, can be added to the VA virtual storage and then assembled on-stage. The key concept of the project was simplicity in use and designing. The main argument for this was that the effect of photorealism is not necessary for a sketching phase, thus images created within the VA environments appeared more like 3D collages, wherein discrete objects were juxtaposed. The project was supposed to create an atmosphere for art-making, becoming a medium for visual improvisation.

The main challenge behind the VA, as outlined by the principle author, was the creation of environments that (1) complement human creativity instead of replacing it; (2) serve as a means of maintaining critical human-to-human dialogue about the creative product; and (3) are useful for creative problem-solving rather than for scrupulous technical description. It was conceived as part of an on-going research programme, the main objective of which was to investigate whether the interaction between computer technologies and creative practitioners provided a real advantage for theatre-making. The VA was planned

as a platform for the creative re-shaping of design ideas and concepts, support and development of design-skills, and improvement of the design-quality of computer applications. One question that needs to be asked, however, is whether the intended outcomes of the project were fulfilled fully. In order to answer this, I conducted a thorough evaluation of the VA through my personal creative interaction with the software. Furthermore, I built my assessment of the project upon the information I extracted from its evaluations, academic articles and descriptions of the package. As with the THEATRON Case Study, the detailed information of the actual testing of the project is provided in Appendix Four of this thesis.

### **3.5.2 Evaluation**

In 2001 Prof Colin Beardon wrote about the VA project:

During the design, I have felt that I, as a software designer, have made an important transition from a technically-oriented software designer (i.e. a computer scientist) to a designer-maker of software (i.e. a craft worker). The full implications of this transition are not yet clear for sometimes there is a definite need for technical skills, but the main thrust of it lies in a revised design philosophy. I am working with a user community in a creative interaction, where my creative skills are being employed to understand their domain at some deeper level and to posit, in software form, some new reality/code within which they may themselves become more creative. This has required a major re-think of design practices and a merging of technical software design and designer-maker practice.

(Beardon, 2001

Available: <http://www.cultivate-int.org/issue5/creative/>)



There is little doubt that software has to be accessible and, foremost, relevant to the field, providing an appropriate medium for creative practitioners. The VA project attempted to translate a diversity of the working styles of theatre designers into its software interface, which can be characterized as immediately accessible (the time of learning the VA package, as estimated by the creator, is about 10 minutes) and simple in use (the number of given functions is limited to about 40). It simplified the process of drafting to its very basics, allowing its users to create common geometric shapes directly within the software and importing existing images from the external files. Furthermore, this software also offers a sketching facility to actually draw pictures, which then exist as separate objects on the virtual stage. The program contains a range of image manipulation tools (e.g. resize, flip, pattern, color, group, and text notes), masks for different shapes of the lower surface (e.g. floor), animation, and a two-dimensional light filter, which controls the shape, color, contrast, diffusion and location of light. In addition, the sketches created within the VA files can be saved in a format specific to the program, but also as a VRML version, in order to be viewed in on/offline regimes through a VRML plug-in to any Internet browser, which corresponds closely to 3D modelling techniques.

Early versions of the VA were treated by the users mostly as an easy-to-use device for creating prototype sets. It could be argued that this simplicity of interacting with the VA enabled its users to concentrate fully on the communication of the production ideas, instead of coping with over-complicated software technology. On the other hand, however, the lack of complexity of the available images and program-levels was strongly criticized by the users, characterizing the VA as ‘a theatre image-making sketch book rather than as a

theatre design tool' (Beardon and Enright, 1999, p. 6). In March 2002, the later version of the VA (2.0) software was reviewed by Aidan Rowe, a Senior Lecturer in Graphic Design at the Surrey Institute of Art and Design. He attempted to evaluate the application not only from a practical point of view, but also looked at its role in the educational setting. It was emphasized that the VA was aiming at a very specific audience and, unlike other creative programs, which try to intensify universal value by offering too many complicated features, is meant to be easy to use, quick to master and limited in scope. There is little doubt that the VA interface contributes extensively to the straightforwardness of using this software. However, despite the fact that its navigation icons indeed improved the functionality of the program, they do lack consistency of style and make the whole program look unfinished.

The VA is much simpler to use for sketching than, for example, 3D Studio Max, which demands a strong computer background and also long-term tutorials. However, after my personal acquaintance with the software, my overall impression of it was rather ambivalent. There was an inconsistency between the simplicity of the software interface and a number of inadequate technical developments that could potentially cause frustration, particularly, in an IT-literate user. For example, such minor detail as an *undo* option works only once; if used again, it will undo the *undo* (i.e. restore an object/figure to the original state before the first command). Additionally, the keyboard *undo* (Ctrl + Z), which is used by almost all creative practitioners, does not correspond with the VA software, which admittedly prevents the drafting process from running smoothly. Perhaps the most serious disadvantage of this project is that it was quite difficult to obtain any explanatory information or, in other words, to access the 'help page', while using



the software. I have some big reservations about not integrating the User Guide within the program, but keeping it separately on the VA website. It was concluded that such an arrangement benefits neither the efficiency nor speed of the sketching process. On the other hand, however, the VA contains a number of useful features, such as, for example, an opportunity to view sketches of the sets interactively and also an ability to play through twenty stage settings in sequences.

In August 2006, I undertook the challenge of creating a random piece of set design, as a practical exercise in using the VA application. Unfortunately, the software's instability entailed the use of a lot of time and effort in the accomplishment of this simple task and, eventually, in saving the draft (Fig. 8). Below, I also provide two other examples of employing the VA as a tool for the creation of theatrical sets. The first sketch (Fig. 9) was made by the students at Malmö University College, Sweden during a one-week workshop in October 1998. The second one (Fig. 10) was created by the students at Exeter School of Arts & Design, UK during a six-week module in spring 2001.

Despite all the inconveniencies, I very much enjoyed the process of interacting with the VA, and would have been willing to use this program to create quick sketches, if technical issues had been resolved. However, using this software in its present state is very time-consuming, which works against one of its key goals. This study argues that many scenic designers, professional and amateur, would prefer to take a piece of paper and colored pencils for drafting their future set or, alternatively, even learn a more complicated software package, rather than download the VA application.



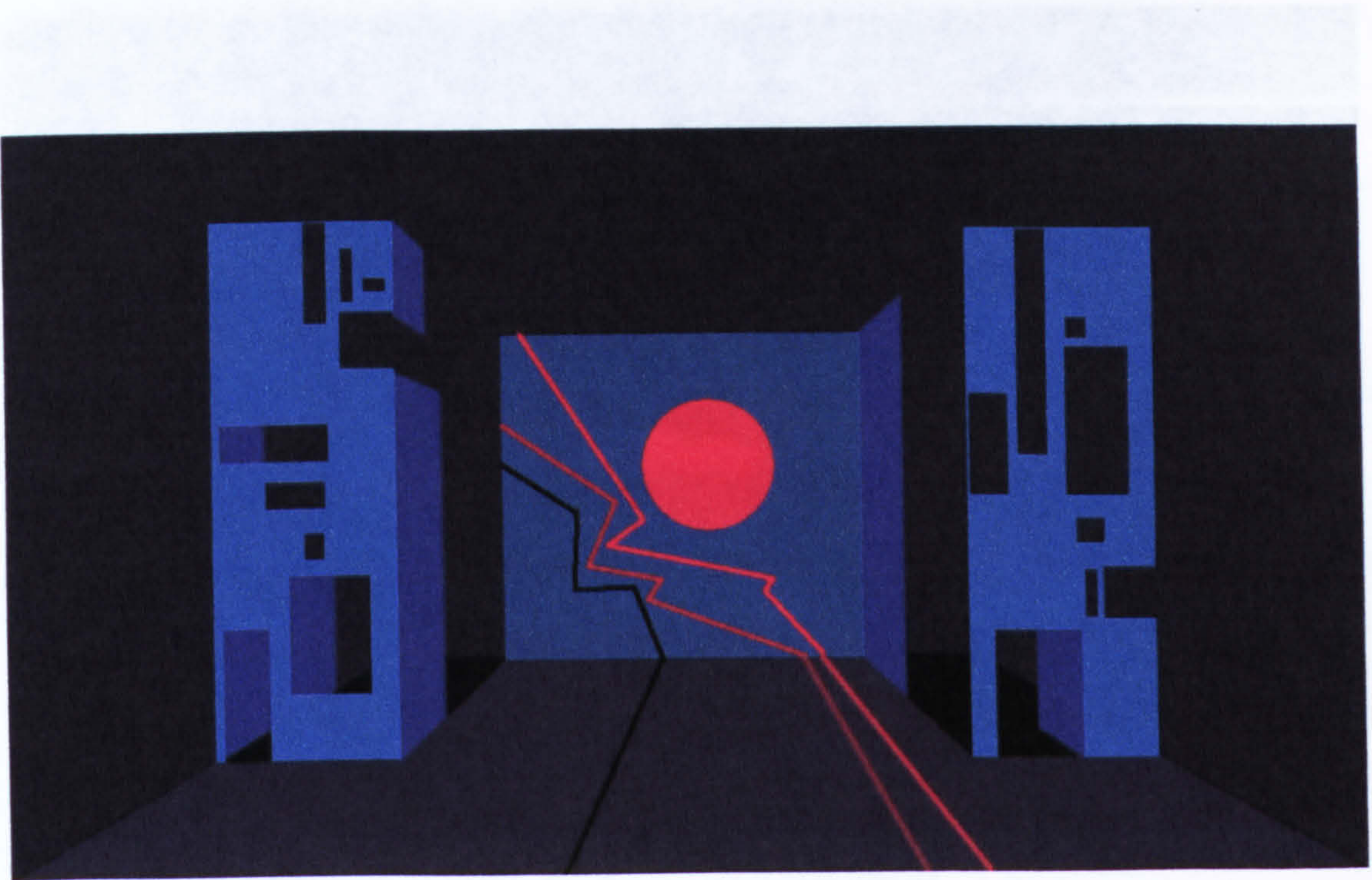


FIGURE 8: 2D Model created using the VA software in August 2006. Author: Iryna Kuksa



FIGURE 9: 2D Model, The Tempest. Source:  
<http://www.cs.waikato.ac.nz/~cbeardon/VA/ex/tempest.html>





FIGURE 10: 2D Model, A Dream Play.

Source: <http://www.cs.waikato.ac.nz/~cbeardon/VA/ex/dream.html>

As with Case Study One, I conducted an online questionnaire (the full version is available in Appendix Three of this thesis) with Professor Colin Beardon, requesting his personal assessment of the VA project's outcomes. He emphasized that one of the positive results of using the program was 'enabling users to think about performance in a visual way, without necessarily getting involved in technical (staging) issues.' Additionally, the project was of a great importance in illustrating how software for 'theatre people' should be designed and built. Professor Beardon agreed that the lack of technical expertise, mainly due to insufficient funding, caused many problems with the product's reliability and usability, which was reflected in very limited uptake.

Below, I will outline the overall effectiveness of the VA project based on the evaluations above (Table 8).



TABLE 8: The Visual Assistant Project Evaluation. Author: Iryna Kuksa

Criteria		Project Objectives	Evaluation
Learners' Profile	<p>Characteristics:</p> <p>Learning Style:</p>	<p>Creative practitioners in the area of production design.</p> <p>User-centred creative learning with immediate practical outcomes.</p>	<p>The VA software is targeted at a small and specific audience: theatre or set designers and students. It introduced the learners to the process of designing for the theatre and acted as a multimedia tool for enhancing the process of exploration of theatrical world. However, the VA users, especially with good computer skills, might find the lack of technical sophistication of the software quite frustrating, which could potentially jeopardize the outcomes of their user-centered learning, or even cause overall loss of interest in using the program or creative software in general.</p>
Learning Environment	<p>Format:</p> <p>Instructional Goals:</p>	<p>Independent or as a part of a workshop/module.</p> <p>The VA enables the users to rapidly and economically visualize theatrical sets – i.e. simulation of a 'learn by doing' process instead of building full-size sets.</p>	<p>The software retains simplicity of use, in order to enhance its usability amongst theatre professionals, but also within the world of education, allowing students to plan and fulfill end-of-year shows, art-shows and general displays. However, behind this simplicity, there are too many technical issues that have to be addressed. Even the creator's statement: 'You download this software at your own risk. We can accept no responsibility for any consequences that may follow from running this software' – implies that the VA's learning environment is not stable. Many set designers (including myself) would prefer to use conventional means of drafting or learn a professional software package.</p>



Program Content	<p><b>Accuracy:</b></p> <p><b>Currency:</b></p> <p><b>Activity:</b></p>	<p>A choice of stage shapes; possibility to control the size, shape and color of the lighting, and populate the stage with 2D elements created within VA or imported in from other programs.</p> <p>The VA is planned as an ongoing project and a part of the multimedia tool kit (Producer's Assistant, Director's Assistant, Writer's Assistant, and Visual Assistant).</p> <p>There are four degrees of freedom (three dimensions and time sequence) available for creation of the sets and also there is a possibility to produce simple animations with them.</p>	<p>The VA allows the import of existing 2D images from the external files and creation of common geometric shapes within the software. Light and shade are under the direct control of the user both at object and scene level. The elements can be moved around the stage, and their attributes (such as size, color, orientation, transparency, proportion, etc.) can be adjusted, in order to create basic animations that illustrate scenes taking place on the stage. Any draft could be saved as a VRML version of the model, which can be viewed in 3D. The VA, however, has not been updated or further evaluated since 2001/02 and there is little known about what happened to the other three parts of the multimedia kit.</p>
Technical Aspects	<p><b>Presentation:</b></p> <p><b>Navigation:</b></p> <p><b>Quality:</b></p>	<p>Self-explanatory, visual, and immediate interface.</p> <p>Navigation icons and object-manipulation tools.</p> <p>The combination of 2D and 3D representations – i.e. a new <i>code</i> for visualizing theatrical space – acts as an extension of sketching techniques and their overall quality for theatre performances within 3D environments.</p>	<p>The users of the VA package create within a front viewing position, which is central and at a fixed distance from the nearest side. There is also a top viewing accessible directly above the centre of the stage, which appears as a square. A range of image and object manipulation tools are available for the users, as well as a variety of masks for the different shapes of the stage. The VA interface, however, lacks consistency of style, which make the program look unfinished. Furthermore, the lack of explanatory information on the available features often makes the software difficult to navigate and use. Finally, such disadvantages of the VA as, for example, the overall technical instability of the software (i.e. numerous 'crashes') threatens the efficiency and speed of the draft-making.</p>

Documentation	<p>Guides:</p> <p>Materials:</p>	<p>Downloadable for both Macintosh and Windows platforms with the User Guide available on the main VA website:  <a href="http://www.cs.waikato.ac.nz/~cbeardon/VA/index.html">http://www.cs.waikato.ac.nz/~cbeardon/VA/index.html</a></p> <p>Examples of the set designs created in the VA, origins of the project, publications, links to related materials, and contact information are available on the main VA website.</p>	<p>Keeping the VA User Guide outside the program on the project's webpage negatively affects the overall quality of interaction with the software. Also the latest examples of using the VA as a creation tool (i.e. the works of the students in the Exeter School of Arts &amp; Design) is dated April 2001, which means that since then, no further workshops have taken place in a university environment.</p>
Effectiveness:	<p>The Visual Assistant was designed specifically for theatre use with, as was claimed, much broader potential application, for example, in theatre education. It was also presented as part of an on-going research programme with the main objective of investigating whether the interaction between computer technologies and creative practitioners provides a real advantage for theatre-making. In reality, however, it is simply a quick-and-easy-to-learn piece of software for the creation of theatre sets using predominantly collage techniques with no real influence on creative learning and practice. Despite the fact that the VA offers a number of useful features for creative practitioners such as aforementioned collage, simple animation and VRML files, this software has not been updated or re-evaluated since 2001/02, which very much affects its currency and relevance to contemporary theatre practice and education.</p>		

The VA project can be considered as a relatively simple application, which aimed to help creative practitioners concentrate on constructing the general theatrical atmosphere rather than details, and which has not yet been superseded. This project was mostly concerned with finding new modes of user-software interaction, instead of focusing entirely on IT as a primary form of delivery. Indeed, it had some inconsistencies in the interface design and there are some technical inconveniences in using the program. However, as with other user-friendly software (e.g. Google SketchUp) the VA is a simple, but powerful tool for a relatively quick expression of creative ideas for set designs. The project helps to fill a gap that previously existed in the software market, and could possibly be employed within the world of education as a means of interactive display. If designed thoroughly, this sort of computer programs has the potential



to influence existing methods of expression in theatre design practice and education.

### 3.6 Discussion

**‘The presentation and performance of self through the creation and “up-loading” into the virtual theatre of a personal website, and the interaction of a performance website, have created significant alternatives to existing narrative models, forms of representation, dramaturgies and physical places of performance.’**

**(Baugh, 2005, p. 219)**

Importantly, my analyses demonstrate that new media technologies have a double-sided impact on the world of theatre education and design, with two absolutely different outcomes. First of all, the innovative technological devices serve to enhance the established ways of how we learn about the theatre and stage design. On the other hand, they also attempt to change the very nature of scholarship and theatrical performance. This is hardly surprising, because, at present, the development of technological devices is so rapid that they get modified, simplified, miniaturized on an almost daily basis and become routinely integrated into our everyday lives. For example, wireless connectivity and contemporary Global Positioning Systems (GPS) have already become commonly accepted phenomena, enabling an absolutely new user-computer interaction. These technological innovations enabled some museums and other cultural sites to revolutionize their methods of presenting secondary resources (e.g. background information on the exhibits) to their visitors, in relation to the displays. The TATE Modern Multimedia Tour, for example, gives its users the possibility to arrange an exhibition visit according to their preferences through the use of a hand-held computer, which represents a fully-fledged information tool. This type of mobile access technology provides detailed information about individual behaviour

during the cultural site visit. It enables users to collect an array of data about visited areas and, in addition, traces the users' physical locations and offers flexibility and freedom of choice regarding the program of a visit. All this data also serves for the evaluation of an exhibition and its services.

The evidence from this chapter suggests that one of the main concerns, which presently exist in the area of theatre studies, is the issue of how convenient, presentable and accessible new media are for educational institutions and also creative practitioners. Baugh (2005, p. 219) argues that:

The technologies of computation that have had such significant effect upon the theory and practice of theatre, performance and scenography, and that have simultaneously both enabled and reflected the 'de-framing' and destabilization of the theatrical experience, have also been the technologies that have enabled internet access to knowledge and information and have generated an unprecedented ability to inter-relate with the world in ways that are similarly not 'framed' in colonial authority.

Indeed, the integration of such delivery methods as the WWW and the Intranet has enabled a more advanced level of personalization, making the customizable interfaces more flexible and suitable for individual demands and creating a strong link between various types of institutions (e.g. universities, libraries, archives, and commercial firms). The DigiCULT Technology Watch Report 2, released in 2004, states that the advantage of interconnections between information units and of searching across institutional resources provided by computer technologies is that it helps in dissolving the lines that separate different cultural heritage, educational and commercial organizations. There is little doubt that such approach to content sharing helps in establishing new kinds of communities and possibilities to communicate within them; on the other hand, however, these new spaces could



promote the potential risk of spectators' isolation and detraction from the social aspect of cultural experience.

The main objective of using computer technologies in theatrical space is to investigate new ways of designing, staging and effective teaching. This study argues that it is crucial to develop visual skills in theatre students, enabling them to use imagery as a creative tool, but also as a means to analyze theatrical performances and artefacts. New media give the visualization process an improvisatory quality and, furthermore, could re-educate our existing perceptions of actual theatre space and even ourselves, as technology users. Traditionally, visitors to cultural sites, members of theatre audiences and students have been regarded as passive recipients of information, rather than active participants in its interpretation and utilization. This chapter has attempted to illustrate that, now, the situation is gradually moving towards the personalization of knowledge delivery. The accessibility and flexibility of new media technologies support multiple learning styles and give the learners a unique opportunity to configure the form, language and level of the information necessary to complete a course. It should be borne in mind, however, that the introduction and implementation of new learning methods (and consequently devices) should be supported by the development of a content that addresses present educational needs and satisfies a diversity of learners. One might argue that without the collaborative approaches to study, there is a possibility that students with low motivation may get confused about activities and deadlines and feel isolated from the teacher and their course-mates. This study reveals that, at present, the majority of online courses and modules are missing the social aspect of the learning process, or, to be more precise, social engagement, interaction, collaboration, and the process of sharing knowledge. It seems

possible, however, to overcome this social exclusion, by providing a template structure for the course information through the creation of digital databases, or the simple selection of specific online or digital resources for students to use independently and within in-class seminars.

Unfortunately, if used inappropriately, technology can have a negative impact on learning outcomes and even function as a copy-and-paste plagiarism device that significantly lowers the overall quality of a study process. Valdez *et al.* (2000) argue that in order to avoid this, there is a need to match technological applications with the intended learning goals, have critical access to hardware that is appropriate to the study expectations, and also ensure that the software design and instructional methods surrounding its use are congruent. There is little doubt that the process of learning is a complex phenomenon, which should be handled with care. This study suggests that at the present stage of technological development a *blended learning* approach (i.e. an amalgamation of online or computer-based and face-to-face elements of knowledge delivery) has great potential to become widespread in the theatre studies classroom. First of all, it incorporates a mix of formats, media and activities with more efficient learning outcomes; and, secondly, it gradually moves learners from 'traditional' classrooms to e-learning, making new changes easier to accept (Driscoll, 2002, p. 1).

### 3.7 Concluding Remarks

The language of contemporary interactive performance, theatre design and education is being established through the global use of digital communication technologies. It can also be argued that more than ever modern digital applications (i.e. software packages for theatre-makers and multimedia study modules) and



even the overall theatrical atmosphere of a performance space depend on how these digitalized spaces are managed and perceived. Indeed, computer technologies offer vast amounts of information that require users to develop specific thinking skills to sort, analyze, and synthesize digital resources. However, the issue of controlling these digital applications is an important one. It requires not only familiarity with the equipment and knowledge of software, but also motivation, which lies at the heart of the human-computer interaction. Modern video and audio technologies, 3D modelling and animation software help users to access visual and textual databases through direct communication, changing them from mere spectators or consumers of information into the active participants in the very experience. New technologies can also transform dramatically any physical surroundings (e.g. museums, theatre studios, exhibitions and classrooms) into multimedia narrative spaces. These spaces, if used appropriately, could be more effective in getting educational or visual messages across, giving participants a maximum comprehension of information delivered.

Certainly, there are several issues to be considered before engaging in the development of new digital means for theatre-making and education, for example, the danger of social exclusion while interacting with the digital product, frustration caused by the project's underdevelopment (both technological and conceptual) and certainly sufficient funding. This chapter aimed to illustrate that these problems could be avoided, if essential research and necessary evaluations and testing of the digital products are undertaken. For these purposes, I have developed an evaluation framework, which was applied to the two case studies – the THEATRON online module and the Visual Assistant software. My analyses showed that despite the THEATRON multimedia module's only partially

successful attempt to pursue a computer-based strategy of teaching, with simultaneous support for different learning activities, this project was an important stepping stone in developing future interactive digital or online resources, where learners are motivated, not only by engaging with the technology itself, but also with their teachers and fellow students.

Furthermore, the Visual Assistant project attempted to offer an alternative to the complicated professional computer programs for creating 3D environments and objects, by introducing a straightforward free-downloadable piece of software, which aimed to enable the creative exploration of theatrical space. This program, however, has been unable to provide either thoroughly developed interface, or contextual support, explaining, for example, the essential principles of design. Although the VA represents exploratory and playful software, it lacks a crucial learning dimension, which made it impossible to place this project within the educational setting of the theatre studies classroom, as was intended. The outcomes of this chapter also illustrate that at present, professional software packages are still much more beneficial for creative design practices, even if they take longer to learn.

Obviously, it is crucial to enable scholars and creative practitioners to explore actively and creatively a wide range of resources related to their areas of interest, without being limited to established linear models of analogue information. Thus the results of the above investigation indicate that there is a need to develop *combined* digital packages that equally contribute to theory and practice in the field of theatre studies. In order to promote new ways of studying scenographic artefacts, in the next chapters, I will explore this issue further on



theoretical and also practical levels and will illustrate my findings by using Norman Bel Geddes' set design for *The Divine Comedy* as an example.

## CHAPTER FOUR: NORMAN BEL GEDDES AND THE NEW STAGECRAFT OF THE 20<sup>TH</sup> CENTURY

'Transformation was a key word in the late nineteenth and early twentieth centuries, becoming significant not only in the world of science... History increasingly had to confront the changing of forms in which experience was expressed – often rapid change because of technological innovation.'

(Susman, 1984, p. 234)

This chapter develops from the Artist Paradigm subsection (Chapter Two) and further explores the evolution of the role of the creative practitioner in theatrical space. The thorough theoretical overview undertaken in Chapter One and Two, allows me to look further into the development of scenography and new technologies from an historical point of view. Here, I particularly focus on the early twentieth century period, investigating the importance of the New Stagecraft movement and its influence on the transformation of scenographic practices in North America and Europe. The main focus of this chapter is the life and works of the American stage and industrial designer Norman Bel Geddes (1893-1958), whose role and visionary works I attempt to place within historical settings, without aiming to settle a dispute over attributes and contradictions of the New Stagecraft. Here, I will discuss Bel Geddes' professional development in creating scenic environments and experimenting with theatre lighting, with particular focus on his design for the production of *The Divine Comedy* (1921) by Dante Alighieri, which will be further investigated in the following chapter.

While scholars generally agree on the historical importance of Bel Geddes' industrial design projects, his impact on theatre design seems largely overlooked, or as a minimum misjudged. My analyses reveal several pioneering aspects of Bel



Geddes' work, which may have had a stronger influence on the radical transformation of American theatre than previously realized. I strongly believe that his innovative set designs are no less visionary than those created by Adolphe Appia and Gordon Craig at approximately the same time in Europe. I hope that my work will stimulate further interest in Norman Bel Geddes' contribution to the twentieth century theatre.

#### 4.1 Methodological Notes

The research for this chapter was conducted at the Harry Ransom Humanities Research Centre (HRC) in the University of Texas, Austin in the USA. I extracted original data from various primary sources held in the local archives, including *The Miracle in the Evening*, Bel Geddes' autobiography published in 1960, and his personal files, consisting of sketches, photographs, correspondence and notes, which will be used further in the following chapters. Additionally, I examined various articles and reviews written in response to Bel Geddes' theatre designs, and also make novel use of information from Christopher Innes' essay *Theory, Practice and Modern Drama*, as well as some other written materials. Unfortunately, there is only a small amount of published research available for academic study of Norman Bel Geddes' theatrical projects. This demonstrates the necessity of initiating the first serious discussion and analysis of this subject, which the present thesis attempts to address.

#### 4.2 The New Stagecraft of the Twentieth Century: A Brief Introduction

'Absence of design is still design. Any arrangements of space or objects, any movement through or across that space [the stage], is design.'  
(Aronson, 2005, p. 6)

The early twentieth century witnessed radical ideological changes, which dominated every aspect of life in Western society. They were clearly reflected in contemporary, highly politicized theatre, which promoted societal *trans-formation* through the nature of theatrical performance (e.g. the works of Bertolt Brecht and Vsevolod Meyerhold), and could be classified as the defining mark of modern drama. The twentieth century European theatre was heavily theory-oriented and preoccupied with textuality of different kinds. This fixation gave birth to theatre journals and schools with a major focus on theoretical research, instead of practice-based applications such as, for example, actor-training. Innes (2003, p.3), for instance, points out that even the practitioners in contemporary theatre were also keen on writing essays, books and creating theoretical systems:

Shaw accompanied his plays with philosophical prefaces that almost outweigh the dramatic scripts (897 pages to 1125 pages in the Hamblyn 'collected works' edition). Stanislavski's work is only judged to have become important when he developed a system, and defined it in a treatise. Even such anti-verbal movements as the Dadaists and Surrealists wrote manifesto after manifesto. Above all, there is the example of Bertolt Brecht, who not only developed a style of dramaturgy explicitly based on political ideology, but wrote extensive theoretical essays to explain and justify his plays – and significantly, it is Brecht's theoretical writings that have had far more influence than his actual plays. The trend has continued in the second half of the century. Grotowski's productions in the 60s were a revelation, but it was his book 'Towards a Poor Theatre' that served as a catalyst for the American avant-garde – while his followers, like Richard Schechner or Eugenio Barba, moved from performance to extensive writings on theatre anthropology.

It seems that Innes' understanding of the validity of such published materials is rather overstated. There is a strong polemical thrust to such an attitude. This study argues that although Appia, Craig, Brecht and Stanislavski had written records of their works, this was not the sole reason why their contributions were valid and



valued. Indeed, one might point out that 'modern design began with the theoretical writings of Adolphe Appia and Edward Gordon Craig' (Aronson, 2005, pp. 15, 17), but, on the other hand, these key creative practitioners of that time were also preoccupied with a visual and conceptual unity of stage design. Both of them used the language of visualization widely; however, due to insufficient practical applications they could be arguably described as purely theoretical catalysts of theatrical evolution. For example, Appia managed to write and publish his thoughts on staging Wagnerian opera a long time before he practically accomplished some of these ideas. Furthermore, Gordon Craig was fascinated with totally abstract theatre, which, as Innes (2003) suggests, might be perceived as the materialization of pure theory. Although it could be argued that theory is the starting point for any type of performance to be created and further changed or improved, this study is convinced that such creative practices as stage and lighting design do not easily fit within restricted parameters of theoretical approach. I have some big reservations about Innes' (2003) claim that Norman Bel Geddes' inability to publish, resulted in his achievements passing partly into oblivion. Without a doubt, Bel Geddes never managed to provide any theoretical background to his creative work, apart from his autobiography *The Miracle in the Evening*, which, certainly, gives some understanding of what he was trying to achieve. It should be noted, however, that he started designing during a time, when lots of creative practitioners of different kind were interested in applying a new visual language for expression and documentation of their ideas – photography. It certainly could be claimed that Norman Bel Geddes, as a true technology supporter and also inventor, deliberately chose this means of detailed visual recording for many of his productions, including *The Divine Comedy's*

performance on a fully-functional stage-model. Indeed, there is a possibility that Bel Geddes did not attract extensive academic study because of the failure to put his theories in writing; but another possibility could be that his strongly visual language, which was evidently lacking textual explanations, was too complex for Bel Geddes' contemporaries to, firstly, accept and then understand.

At the beginning of the twentieth century, Western theatre practice began to flourish. Despite this, scenographic techniques used in theatrical space remained comparatively simple. The methods then employed for creating scenery – usually pictures painted on flat canvases ‘pretending to be solid three-dimensional objects’ (Beacham, 1994, p. 1) and illuminated with white light – as one living in the twenty-first century might argue, completely destroyed the feeling of theatrical illusion. In fact, stage design at the beginning of the last century has been described as a poor version of easel painting (Aronson, 2000). This highly detailed, realistic, even ‘archeological’ approach to set design provoked a strong reaction against naturalism on stage and, furthermore, the rapid development of simplistic, expressionistic and spiritualistic tendencies in designing for theatre. A new stagecraft emerged. In 1916, the first issue of the *Theatre Art* journal under Sheldon Cheney’s editorship defined the main goals and limitations of this new movement in contemporary theatre. This innovative modernist approach to theatre design promoted elimination of all the ‘stage clutter’ and unnecessary scenographic details, and suggested the creation of precisely defined theatrical space through the use of symbolic or even emblematic design features. Contemporary creative practitioners experimented with various types of staging, including environmental set design, in order to produce scenery that fulfills all the specific needs of a plot, rather than any individual style



(Mergenthal, 1996). Despite the influence of some of the Bauhaus artists, who during the first half of the twentieth century went to the USA and proposed new approaches to architecture and design training (Baugh, 2005), only a few ambitious theatre projects were accomplished in actuality, the rest existed only on paper or as precisely scaled models (e.g. *The Divine Comedy* by Norman Bel Geddes). Furthermore, modernist practitioners tended to design adaptable, multipurpose auditoriums, aiming to accommodate new theatrical concepts, which were difficult to fit within the architectural restrictions of contemporary theatre buildings. The most commercial theatre venues, however, retained an utterly conventional approach to performance in this period, using the traditional proscenium arch.

Nevertheless, the New Stagecraft gave birth to incredible theatrical sets, successful experiments with lighting, and also redefined the meaning of theatre space and the role of the actors and the spectators within it. All these transformations had a great impact on Norman Bel Geddes' intention to establish himself as one of the principle modernist stage designers and architects in the USA from the 1920s onwards. In order to integrate Bel Geddes' visionary approach to theatrical space within the body of this chapter, it is necessary not only to analyze his philosophy of designing for the theatre, but also to touch upon his life.

### 4.3 Norman Bel Geddes and the Modern Theatre

'Norman Bel Geddes has those qualities which I most cherish in Americans, the inborn power, the natural pride, the childish delight essential to begin everything at the beginning, to discover the world anew, and with clear comprehension to establish himself practically in it. He is a master

builder in the widest sense of the word. He builds castles in the air but he lays their foundations solidly in the ground.

... He is at once a visionary and an organizer. His love for the theatre is fortunate, it is sensuous and fruitful. In the middle ages he would have built cathedrals and made of them the cradle of our theatre.'

Max Reinhardt, November 23, 1923

(in Geddes, 1924, p. 3)

Norman Bel Geddes was a visionary stage designer, theatre architect, director, producer, industrial designer and an author. Originally, Norman *Melancton* Geddes, he transformed his name using the prefix *Bel*, which was an abbreviation of Belle Snider's (his first wife's) first name. This rather eccentric and unforgettable name served incredibly well during Bel Geddes' professional career. As a stage designer, Norman Bel Geddes was undoubtedly influenced by the innovative European New Stagecraft movement, which encouraged him to reject the ideal of realism on stage, putting suggestion above representation. His futuristic designs and desire to make the world 'cleaner, safer, prettier, and better for all men' (Roberts, 1979, p. 6) by employing advances in science and industry can be defined as *hope-giving* to the economically depressed America of that time. Thus, it is not surprising that one could characterize him as a visionary for the American people. Bel Geddes' designs were not only dramatically expressive, but also highly technical, extremely extensive and practical on all levels of production. Innes (2003) argues that, similar to Craig's professional habits, Bel Geddes also tended to construct large scale 3D models of his future sets and often of the theatre buildings to accommodate them. Each model represented in detail every individual setting, filled with figures of actors wearing usually neutral costumes, and also provided space for action, movements, and extremely complex



lighting effects. His models were so precise that their exact reproduction in real-size was unquestionable. Additionally, Bel Geddes provided architectural blueprints and elevations simultaneously with detailed cost estimates, which he usually exceeded, while realizing his projects in different theatres around the country. Bel Geddes' career extended across one of the most interesting periods of artistic and theatre history in the USA and his contribution to the development of theatre design and also to the introduction of the new profession of industrial designer was of great importance.

### **4.3.1 Biographical Sketch**

Norman Bel Geddes was born in Adrian, Michigan, on April 27, 1893.

Behind Bel Geddes was a long family tradition that 'traced the Gedds clan back to 1537, as recorded in Sir Walter Scott's novel, *Red Gauntlet*' (Bel Geddes, 1960, p. 9). Bel Geddes' father, Clifton Terry Geddes inherited a good fortune after his father's death, which soon after was transferred into stock and was then lost during the country's first panic. Shortly after that unfortunate event, the family moved to Chicago and for a while lived in the Ellis Park Hotel, where young Bel Geddes met John McCutcheon, one of the country's most influential cartoonists. McCutcheon was the first person whose talent, sketches and explanations of how to draw people persuaded Norman Bel Geddes to pursue an artistic career. Very early in his life, young Norman began making notes on live theatrical acts, copying parodies of songs, eventually turning his observations into a ten-minute comedy act with music and costumes intended to caricature the young country bumpkin. This work was accepted by the Gus Sun Booking Office at Springfield, one of the leading vaudeville agencies in the country at that time, and soon after

was performed by the author at the theatre in Byesville. The manager's appraisal, received after the show, stated: 'You are the worst we have ever had' (Geddes, 1960, p. 86). Nevertheless, this experience did not affect Bel Geddes' decision to enroll in the Cleveland Institute of Art, where he learned the theories and practice of Industrial Design, as well as painting, life drawing and sculpture.

Later in his life, while working in Detroit for Apel-Campbell, a commercial art firm, Norman Bel Geddes spent one night of each week at the local theatre, where he read each play shown there, before seeing it. He was doing this in a vigorous attempt to imagine what the play should look like and compared his vision with the actual representation later on.

The technique of play construction fascinates me from the first. It became apparent that a wide variety of movements and locations for scenes and parts of scenes were not only possible, but could produce varying degrees of emphasis. The development of individual scenes, first for their own value, and then for their value to scenes that followed as the whole was built toward a climax, fascinated me. I found the process not dissimilar to chess, wherein every move must be considered in relation to every other future move.

(Bel Geddes, 1960, pp. 128-129)

On a trip to New York City in August 1914, Bel Geddes discovered Hiram Kelly Moderwell's (with whom he later became friends for life) volume of *The Theatre Today*. It introduced him to innovative developments in European theatre design and, most importantly to the visionary theories of Adolphe Appia and Edward Gordon Craig. This knowledge, together with a production of *Sumurun* by the European director Max Reinhardt, which he saw during the same trip in New York, convinced him that the type of theatre he had believed in was indeed possible and, furthermore, that it was needed.



Norman Bel Geddes made his entry into the world of stage design in 1915 with a production of *Thunderbird*. This was his first miniature model, completed with the mechanically-controlled curtains and then innovative spotlights, which he had pioneered in America and used widely throughout his career. Bel Geddes introduced this new way to illuminate the stage, in order to avoid employing traditional flat lighting with footlights, where shadows had to be painted on the set to achieve atmospheric effects. Bel Geddes' extraordinary vision and his design-transformation of theatrical stages received excellent reviews in the American newspapers and journals.

In 1917 Norman Bel Geddes left his first wife in California and, with financial help from Otto Kahn, who referred to him as 'the best investment I ever made', permanently moved to New York. There he attained his first fame with *Boudoir Ballet* and *La Nave*, both produced for the Chicago Opera Company in 1919 (Roberts, 1979). In the meantime, Bel Geddes created many theatre adaptations and set designs that were never to be shown on the real stage. His most remarkable work was, undoubtedly, the fully-functional stage model for Dante's *The Divine Comedy* (1921), which will be analyzed in the following chapter. The year 1922 was the beginning of Norman Bel Geddes' collaboration with Max Reinhardt, which culminated in the production of *The Miracle* in New York in 1924. Bel Geddes' vision of the play led to the transformation of the Century Theatre into a medieval cathedral. The show was a great success and made Bel Geddes world famous. Reinhardt's response to this partnership was:

Working with you was pure joy. Among the many artists with whom I have collaborated in more than twenty-five years, I have never met anyone of such rapid conception, of such flawless understanding. I am convinced that the execution of your plans will outdistance everything that has ever been done

scenically in the theatre. It seems to me, like a mysteriously destined miracle, a man from whom I was separated until now by the ocean, a man whom I met so late in life, with whom I was hardly able to converse, that just this man had made me feel the most intense mutual understanding and harmonious agreement, although he always remained free, unfettered, original and creative.

(in Geddes, 1960, p. 287)

Norman Bel Geddes combined repeatedly his set designer role with that of director and producer of the theatrical performance, or, in other words, he was the single interpreter of a play. Roberts (1979, p. 8) defines this working style of Geddes' as the 'unity of effect' principle, which reached its culmination in his later productions of *Jeanne d'Arc* (1925), *Hamlet* (1929-1931), *Lysistrata* (1930), *Dead End* (1935), and *Iron Men* (1936). Bel Geddes' last spectacle of *The Eternal Road* (1935-37), his joint work with Max Reinhardt, was the summit of his career-long lighting experiments, and once again proved the power of his imagination and his determination to create an innovative and vital theatrical space.

The original autobiographical sketch written by Norman Bel Geddes is provided in Appendix Five of this thesis.

#### 4.3.2 Philosophy of Designing for Theatre in the Early 20<sup>th</sup> Century

This study distinguishes three types of creative practitioners of the early twentieth century. It is necessary to mention, however, that all of them were theatrical innovators, practising an inclusive (i.e. total) approach to theatre space, in order to redefine its boundaries according to each artist's unique perspective. The first type are theatre practitioners, who due to circumstances, managed to realize themselves both theoretically and practically. A good example here would be the outstanding career of Russian theatre modernizer, Vsevolod Meyerhold. During his



professional life he managed not only to accept realism as a working method, while working with Stanislavski in the early years of the Moscow Art Theatre and then consequently reject it, but also to develop the whole theory of biomechanics – a movement-based approach to actor training and to theatrical production (see Leach and Borovsky, 1999).

His revolt against the sterility of the Russian theatre of the nineteenth century was just as sincere as his revolt against the first means by which he hoped to correct the fault. He simply found that a certain honest cynicism in his nature refused to countenance the attempt to create illusion by the faithful and accurate representation of life.

(Sayler, 1920, pp. 202-220)

The second type of creative practitioner represents those with a strong philosophical and conceptual basis to their work, but without much practical application – e.g. Adolphe Appia and Edward Gordon Craig. Appia's visionary designs aimed to realize Wagner's ideal of a complete unification of all theatrical elements; however, it was his theories (i.e. his two major works *The Staging of Wagnerian Music Drama* (1895) and *Music and Stage Setting* (1899)), which have influenced modern theatre more than his practice, because he was offered so few opportunities to apply his ideas. Another limitation of Appia's work was possibly his unwillingness to interpret the drama through any theatrical element other than music. Similarly, Craig treated theatre as a visual and emotional space rather than as literal or intellectual, referring to text as one element of many and certainly not the most vital or prevailing. However, in his 1905 book *On the Art of the Theatre* he introduced a controversial term *über-marionette*, which he never defined properly, provoking numerous debates and speculations on this issue. He

also created a set of abstract designs – *The Steps* (1905) – to illustrate his theories for the future, *free-of-words* theatre, which, unfortunately, he never managed to practise.

The third type stands for the artists, who realized themselves mostly through their practical contributions to the twentieth century theatre, such as Max Reinhardt and Norman Bel Geddes. For example, Reinhardt, like Appia and Craig, saw Wagner's theories as a source of theatre aesthetics. Furthermore, similar to Meyerhold, he also embraced the realistic stage, only to reject it later, and explored new, expressive, and vigorous forms of theatrical representation through applying his personal and rather egocentric vision of the world – a distinctive working method of the key creative practitioners of that time. However, one of Reinhardt's, and also Bel Geddes', most important characteristics was the constant search for the perfect theatre 'a functional playhouse, the right vehicle for the particular play he [Reinhardt] was directing, for the development of the playhouse and its technical advances, and for his methods of repertory and his ways of preparing and rehearsing a play' (Styan, 1982, p. 108). In Reinhardt's opinion, this was necessary for defining the purpose of the drama, and for creating the ideal mixture of theatrical elements for each play. Max Reinhardt was probably one of the most versatile directors in the history of theatre. He managed to found several acting schools in Vienna and New York, produce on average twenty performances a year, applying a different style to each theatrical enterprise, and also control thirty different theatres and companies in his life time. Additionally, Reinhardt developed a series of open-air productions (e.g. *A Midsummer Night's Dream* in the Boboli Gardens of Florence and in the fields outside Oxford – 1933; *The Merchant of Venice* across a real



canal in Venice – 1934-35; *The Dream* in the Hollywood Bowl and the University of Berkeley), achievements, which Bel Geddes, unfortunately, never managed to emulate. It must be noted that Reinhardt had two literary advisers – Arthur Kahane and Heinz Herald, – who helped him with documenting his methods of rehearsal and development of the *Regiebuch* – ‘the indispensable blueprint from which many assistants could conduct rehearsals while the master watched over the results’ (Styan, 1982, p. 120) – and overall with his hectic lifestyle.

There is little doubt that Norman Bel Geddes adopted Reinhardt’s working style, but with several exceptions – he did not have literary advisors, a brother to control the house-journals for the theatres and the workshops, nor such wealth, as Reinhardt. Therefore, it could be argued that he did not have an opportunity (or probably time and willingness) to publish. This study reveals that, similar to other important creative practitioners of that time, Bel Geddes treated theatre as primarily a visual space. He had a very high opinion of Max Reinhardt not only because he had given him ‘his first big chance’ (Reinhardt, 1979, p. 116) to be involved in the production of *The Miracle*, but also because he believed in Reinhardt’s timeless genius. In return, as Gottfried Reinhardt wrote in his memoir of his father, Max Reinhardt thought of Bel Geddes as one of the most imaginative scenic designers that had ever existed. Despite Bel Geddes’ bad temper, drinking, and above all his talent to get the investors bankrupted, both Reinhardt and his son referred to him as a genius with the ‘save-all’ solution in any difficult situation:

In watching Geddes, I was conscious of witnessing, indeed, a genius in action, a Prometheus unbound.

(Reinhardt, 1979, p. 253)

Norman Bel Geddes was indeed an extraordinary man and stage designer. He self-studied scenic environments by analyzing different plays and creating the best plan of action, after considering them from all possible standpoints. The ultimate goal of his studies was to find the most effective ways of how the plays he saw could have been staged differently – in more enhanced ways. After his acquaintance with the works of the New Stagecraft designers (especially Adolphe Appia and Edward Gordon Craig), Bel Geddes began using ‘large splashes of color, the elimination of ornament, the simplification of detail, and the exaggeration of settings and costumes’ (Roberts, 1979, p. 8). Together with other followers of the New Stagecraft movement in America, for example Lee Simonson and Robert Edmond Jones, Bel Geddes emphasized psychology and emotional states throughout the play, by adopting an expressionistic approach to the stylization of the performance. His set design for *The Miracle* is a good example of how he followed Appia’s desire to immerse the spectators in a highly architectural theatrical space, or, in other words, in a complete theatre *happening*. He was convinced that the introduction of three-dimensional staging techniques mostly depended on the designers and their willingness to experiment, and to go beyond the obsolete two-dimensional proscenium stage. Bel Geddes defined stage design as a process for reinterpreting theatrical space together with the objects within it and combining them into a structure, where each part was an essential element of the main concept. He strongly believed that the only way to realize the main idea of the show was through absolute symbolism and spectacle, and that the value of design was simply ‘in its homogeneous integrity in giving significance to an idea and fulfilling it’ (Bel Geddes, 1960, p. 261).



The collaboration with Max Reinhardt was very fruitful for the further development of Norman Bel Geddes' visionary ideas and also for his experiments with theatrical illumination. Reinhardt applied Appia's lighting theories in practice, establishing them as 'a fundamental element of modern stagecraft' (Beacham, 1994, p. 245). Appia's experimental works greatly influenced Bel Geddes' philosophy of lighting design, in which he argued that, by a skillful manipulation of light, objects and costumes can be utterly transformed, and realistic settings can be suggested without scenery (see Bogush, 1972, pp. 419-421). Similar to Gordon Craig, he did not consider actors to be central components of a performance. For example, working on *The Divine Comedy* set, Bel Geddes regarded them as being simply ornaments within the overall stage design and defined their costumes as scenery worn by people. Similar to Max Reinhardt, he participated in a wide range of productions – from operas to modern poetic dramas and symbolist plays, which some scholars (e.g. Innes, 2003) find intellectually inconsistent and rather eclectic. A possible explanation for this might be that Norman Bel Geddes never focused exclusively on theatre art, which was mostly due to his reputation and involvement in the area of industrial design.

Norman Bel Geddes never published a written piece of work outlining his vision of the modern theatre or fully explaining his design principles. In the field of industrial design, however, he produced two books – *Horizons* (1932) and *Magic Motorways* (1940) – together with several journal articles. His only published theatre article was *A Project for a Theatrical Presentation of the Divine Comedy of Dante Alighieri* in *Theatre Arts* journal in 1924. This was indeed very unusual for a designer of such talent and importance, who was living and creating in the era of *theoretical* theatre and exhibiting his designs on a large scale all over

the world (including the Victoria & Albert museum in London, the Louvre in Paris, and the Museum of Modern Art – MOMA – in New York). However, it is necessary to mention that, while working on his theatre designs, Bel Geddes was involved in all aspects of production – even re-writing the script.

As a director he devised a system for coordinating the various components of a spectacle for the most powerful and single-minded effect at any given moment. He would chart the entire play in quarter-minute intervals, dividing the spoken word, tone of voice, lighting, movement of principals, movement of subordinates, and the music, just as a composer would organize the score of a symphony, as his *Divine Comedy* script book clearly illustrates.

(Roberts, 1979, p. 9)

Similar to Reinhardt, Norman Bel Geddes usually started developing the conceptual background of the production with a copy of the play infused with blank pages for notes and drawings; however, he did not have literary advisors (like Max Reinhardt) to edit the material. Fortunately, some of Bel Geddes' working scripts still exist, for example, in his copy of Norton's translation of *The Divine Comedy* (see Chapter Five), in which he outlined the intended action of the performance. These textual resources produced by Norman Bel Geddes are of great research value, but without particular theoretical quality.

There is little doubt that Norman Bel Geddes in his designs aimed to re-shape theatrical space. However, despite the radicalism of his ideas and his extreme vision, this study reveals that he never managed to escape traditional theatrical spaces. Unlike Craig and Artaud, who abandoned the stage in order to promote their new forms of theatre (Innes, 2003), Bel Geddes remained within the theatrical system, undoubtedly, enhancing it, but never creating a revolutionary new type of theatre.



#### 4.4 Concluding Remarks

Norman Bel Geddes was a pioneer of American stage design. He was involved as author and/or designer in more than two hundred plays, theatrical performances and motion pictures. He was also a talented and successful industrial designer identified with the popular 1930s streamlining style in the USA. While working on any of his designs, Bel Geddes never concentrated on a single object or a product *per se*. This study argues that his thinking was much more ‘global’, thus he created entire systems such as theatre buildings for a single production and urban utopias. Bel Geddes characterized himself as a modernist-Renaissance person, attempting to combine his multiple talents in theatre and industry with radical and often futuristic visions and ideas. Indeed, this ambitious approach to design brought him a lot of fame, but the over-complexity of his concepts and, frequent underestimation of the costs, resulted in a number of unaccomplished projects. For all these reasons, his contribution in the area of theatre design, highly rated at the time of the creation of his sets, has remained barely noticed for the last few decades. Unfortunately, it is true that ‘no scholar has judged Bel Geddes worth a monograph; and his name is barely remembered except by experts in American theatre history’ (Innes, 2003). Nevertheless, this chapter has attempted to demonstrate the need for extensive academic research on Bel Geddes’ visionary theatrical designs, created at a turning point in the history of the Western theatre.

This study reveals how Bel Geddes’ incredible productivity and his ability to combine creative thinking with technical knowledge were successfully reflected in every production he designed. Furthermore, he greatly contributed to the development of lighting design, where his technical inventions and visionary experiments with theatre illumination made it one of the most important forces in

the modern theatre. There is little doubt that Norman Bel Geddes was a true supporter of the New Stagecraft movement in early twentieth century America. Despite his failure to stage his most ambitious project of Dante's *The Divine Comedy*, Bel Geddes was able to create a still very ambitious and experimental, but conceivable stage design for Reinhardt's production of *The Miracle*. He wanted to be free from this claustrophobic space, but heavily commercial American theatre and especially fundraisers opposed his intention. Despite these restrictions, Bel Geddes always used theatrical space to its very limits; sometimes to such an extent that, for example, there was no room left for a live orchestra as in the 1937 production of *The Eternal Road*. This extreme set design, however, necessitated the introduction of new recording techniques, in order to provide a musical accompaniment in the course of the show.

Norman Bel Geddes always tended to promote the modernist style in his designs, which had to be fitted within existing theatrical spaces. Bel Geddes' utopian approach to stage scenery and lighting technology was well-known during his career and in many cases creatively encouraged other contemporary theatre practitioners. Unfortunately, however, Bel Geddes' incredible talent for overspending the money of his investors and his lack of flexibility in the modification or adaptation of his sets to a particular theatrical space, led to his failure to fulfill some of his design concepts and even bankruptcy.

'The modernist philosophy as extolled by Adolphe Appia and Edward G. Craig to express the poetic, the mutable and the spontaneous in performance is further enabled with digital technologies' (White, 2006, p. 93). A similar comment could be made about Norman Bel Geddes and his visionary theatrical experiments, which gave birth to his unrealized, but in many ways most



impressive theatrical project for Dante's *The Divine Comedy*. In the next chapter, I will reveal how technologies of computation could contribute to the academic study and research of scenographic artefacts, by analyzing *The Divine Comedy* enterprise as a practical case study.

## CHAPTER FIVE: *THE DIVINE COMEDY* PROJECT BY NORMAN BEL GEDDES – HISTORY, REALITY AND FUTURE

'My head was on fire, I was extremely dizzy. I staggered into the next room and opened my eyes. The room seemed a block wide. I suddenly started to fall. I clutched for some sort of support but there was nothing to grab, and I fell headlong into a bookcase. Dazed and scared, I lay still for some moments, then pulled myself to a sitting position. I discovered that I was holding a book in my right hand. I opened it and, bemusedly, read the same passage over and over again before I realized what it was.

*"As flowerets, bent and closed by the chill of night, after the sun shines on them, straighten themselves all open on the stem, so I became with my weak virtue. And such good daring hastened to my heart, that I began like one enfranchised ..."*

None other than Norton's translation of Dante's *The Divine Comedy*.'

(Geddes, 1960, p. 248)

Realization of theatre today is undoubtedly an intriguing and very interesting process. Since the early twentieth century, theatrical space has become increasingly visionary and technically complex. One of the reasons was the development of the New Stagecraft movement in Europe and North America. In this chapter, I will further discuss practical applications of Norman Bel Geddes' visionary design ideas, with particular focus on one of his most famous theatrical projects – *The Divine Comedy* (1921) by Dante Alighieri. This chapter develops from the Design Paradigm subsection (Chapter Two), whose theoretical base together with Chapters One and Four, allowed me to analyze extensively the significance of the technological impact on the evolution and presentation of theatre design, using *The Divine Comedy* as a visual example. Despite the fact that



this imaginative design-concept was never produced, this study argues that its historical importance for the development of the twentieth-century stage and lighting design remains unquestionable, although largely overlooked by the academic community. Bel Geddes' ambitious project was intended to mark the six hundredth anniversary of Dante's death, and the author aimed to stage the play in Madison Square Garden. He also specially designed the *Divine Comedy Theatre* to accommodate this production and produced a set of plans for a portable stage structure, to be moved around the country and used for performances in various university auditoria and at open-air sites. Norman Bel Geddes spent approximately two years developing a fully-functional model for *The Divine Comedy* production, which was lost during the last century. Currently, Bel Geddes' original idea exists only in the form of sketches, photographs, plans, and an annotated *script*, which are available for research at the Harry Ransom Humanities Research Centre at the University of Texas in Austin.

In this chapter, I will analyze the overall concept of *The Divine Comedy* enterprise, outlining Bel Geddes' innovative ideas and the main technical characteristics of this production, including stage construction, light, sound and costumes. Furthermore, I will examine the original set-model, using the author's drawings and sketches, and Francis Bruguière's photographs, in order to investigate the reasons why the project has never been staged and outline possible implications, which the staging of *The Divine Comedy* might have had for the overall flow of the performance.

*The Divine Comedy's* extraordinary stage construction, although carefully designed, represented one of the biggest challenges for contemporary theatre practitioners. Only with the emergence of 3D visualization computer technologies

and advanced staging techniques can the reconstruction of this production either in cyber- or real theatrical spaces become feasible. This chapter introduces the first 3D computer-generated model of Bel Geddes' original set design, created in order to drastically change the way in which the author's visionary ideas are perceived and valued, but also to serve as a tool for educational purposes. Here, I will present an illustrated process of 3D-reconstruction of the set-model, in order to assess its design-limitations and reveal some inconsistencies found during digital modelling. This 3D reconstruction is an important part of my original educational project – the Set-SPECTRUM, – which promotes new approaches to theatre education and research through employing 3D worlds as a flexible medium for effective and visually-enhanced knowledge delivery. It will be discussed in the following chapter.

## **5.1 Methodological Notes**

As for Chapter Four, the research for this chapter was undertaken in the archives of the HRC at the University of Texas in Austin. All the data, including photographs, plans, drawings, and elevations, was extracted from original sources according to the HRC rules and regulations. Some of the materials relevant to this study were photocopied, others – scanned or photographed with high- or low-resolution and saved in the jpeg. format for further use in this dissertation. The computer reconstruction of the set was modeled from a detailed, scaled layout and front elevation produced by Norman Bel Geddes in 1921. These materials were scanned with the highest possible resolution and transported to AutoCAD 2002 for digital reconstruction of necessary views and then to Discreet 3D Studio Max 7 for further 3D modelling and light setup.



## 5.2 The Design Concept

This project is the result of an idea to express emotional beauty through the unification of action, sound and light. Not only the feeling but the form as it is in the Inferno grows into a different thing by the time it reaches Paradise. As the composition progresses, there is a gradual crescendo. At the end with cold, rigid dignity comes an appalling sense of the vastness beyond the earth.

(Geddes, 1924, p. 13)

Norman Bel Geddes started working on *The Divine Comedy* project after designing several successful musical productions, partly because he was afraid of being identified solely with this type of theatre. It was a very depressing time for him. His inability to concentrate on his work and his constant mental efforts to design something new led to a situation where his imagination, as he described it, became 'overactive'. Nevertheless, it was this 'overactivity' that gave birth to one of the finest designs of the early twentieth century American theatre. Unable to read Dante's play in the original, Norman Bel Geddes had to use translations by Norton, Longfellow, Tozer, Anderson, and Johnson, admittedly failing to appreciate fully many of the play's political, mystical, and purely personal allusions. Although Bel Geddes treated the Norton translation as a working script he cross-compared all versions line-by-line, making notes in the margins, pedantically marking text deletions and rearrangements (Fig. 11). This staging manuscript was devised 'more along the lines of a composer's orchestration than a literal play' (Hunter, 1966, p. 240), with Bel Geddes' original ideas for the dialogues, lighting, movement of the principle actors and the subordinates, and even the music, running horizontally across the pages. These annotations were probably intended to communicate his exact intentions to the production staff. A full outline of the action is provided in Appendix Six of this thesis.



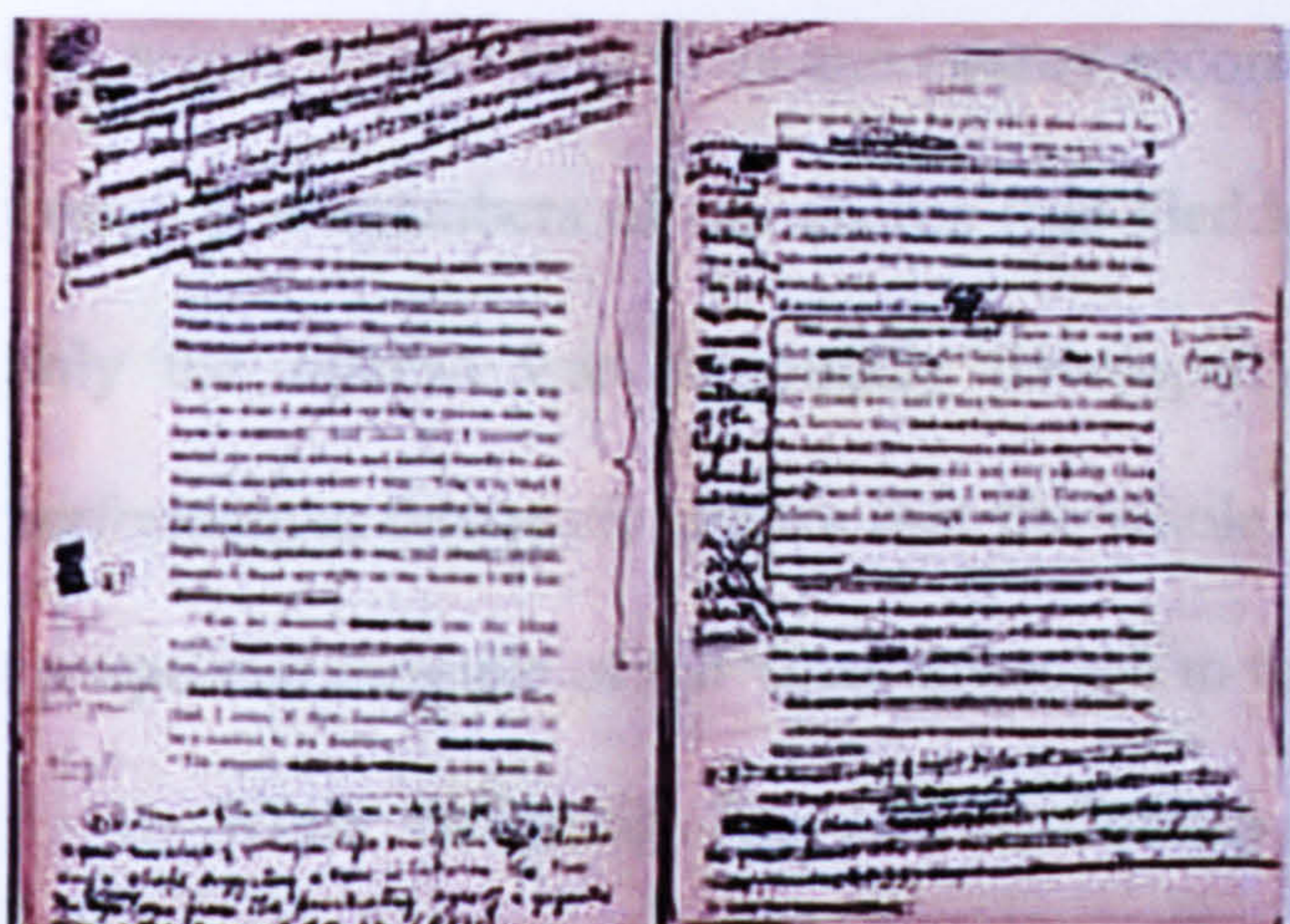


FIGURE 11: Pages 16-17 of Norman Bel Geddes' working script (Norton translation of *The Divine Comedy* by Dante Alighieri); low-resolution scan. Source: The HRC, the University of Texas in Austin

After thorough preliminary work, Bel Geddes constructed a general outline for dramatization, including the selection of scenes. Only seventeen passages were, in his opinion, suitable for visualization in theatrical space.

In undertaking to present *The Divine Comedy* in the form of the theatre I have made no attempts to be literal. I have tried to find and hold the essence of Dante's spirit in its broad sense. It is this universal quality that has brought *The Divine Comedy* through the ages and it is this quality that has inspired me.

(Geddes, 1924. p. 9)

In order to conserve the essence of Dante's vision, but at the same time ensure the continuity of the play remained unbroken, the author arranged the *Inferno* as Act One, the *Purgatory* and the *Paradise* as Act Two. He produced sketches and drawings of the model whilst rewriting the script, making a smooth and coherent development of his visionary ideas possible. *The Divine Comedy* project is an amalgamation of Bel Geddes' abstract thinking, which found its expression in stylized and exaggerated acting, and his design of stage machinery, lighting and sound applications, which were way ahead of their time. The production totaled



523 actors – three principals and twenty secondary characters, each in charge of twenty five members of the chorus (see Geddes, 1960, pp. 247-253). Although only the *Inferno* was thoroughly developed and visualized for actual stage performance, this study argues that the whole production, to some extent, is an exceptional example of the ‘total’ approach to theatre-making.

While designing *The Divine Comedy* Norman Bel Geddes tended to generalize images, costumes, and even characters of the play, making them more abstract and symbolic in an attempt to unify the theatrical expression. For example, the characters of the leopard, lion and she-wolf from Dante’s original text ‘have become simply three awesome beasts which are undifferentiated either in the notes or in the production script’ (Hunter, 1966, p. 241). It was already mentioned that Bel Geddes defined costumes as scenery worn by people, emphasizing that for the production of *The Divine Comedy* they were designed specifically to intensify the background feeling:

The costuming was of great variety. I defined costuming as anything worn or carried by a person, which, oftentimes, was all that distinguished a costume from other scenery. Many of the garments were ordinary enough, while others were highly abstract. The soldiers of the City of Dis were dressed in body masks. There were giant objects, like gargantuan bats, with mobile, telescopic wings. The wings worn on either side of the body, concealed the kneeling actor entirely. In Purgatory the shape of the towers was altered by actors carrying featherlike objects to suggest the wings of two giant angels. In Paradise the actors were covered with gauze to soften their forms.

(Geddes, 1960, p. 250)

Norman Bel Geddes intended to use a number of the masks for *The Divine Comedy* as a means to depersonalize the chorus actors, in order to intensify the uniqueness of the leading characters and to project their facial expressions into the



large auditorium. The masks for the lead characters (i.e. Dante, Virgil and Beatrice) were designed as a series, with expressions ranging from passivity to mortal terror. In addition, Norman Bel Geddes intended to equip all the masks with a unique megaphone construction (Hunter, 1966, p. 241), which would enable the actors to amplify their voices to a great extent while on stage. In the course of this study, it was discovered that the last masks in the selection for Dante's character (Fig. 12) had a remarkable resemblance to the expressionistic character, visualized in the painting by Edvard Munch *The Scream* (1893), which supports the argument that Bel Geddes' vision of *The Divine Comedy* was entirely about expression, exaggeration and abstraction.



FIGURE 12: Francis Bruguière photograph of Dante's mask No 8, designed by Norman Bel Geddes; low-resolution scan. Source: The HRC, the University of Texas in Austin

In addition to visual abstractionism, Norman Bel Geddes also planned the sound design for the production to be an abstract sonority of vibration and tone, where individual musical instruments merge and become indistinguishable. Bogusch (1972) argues that in order to achieve this, he even considered devising new



means of orchestrating these unusual sounds and distributing them mechanically to various parts of stage and auditorium. Bel Geddes described the music for *The Divine Comedy* as inseparable from the lighting and also absolutely free from any conspicuousness (i.e. familiarity). He emphasized that it not only should coordinate with the dramatization precisely in rhythm and color, but also express a drama of unearthly emotions and produce a volume of sound beyond the capacity of the human ear (Geddes, 1924). He envisaged an orchestra of 150 musicians, using drums, brasses, pipe-organs, and planned such unusual arrangements as steam whistles in the foreground and strings behind the stage, and a hidden chorus of several hundred singers, producing a shocking volume of sound through a gigantic concealed megaphone (Cheney, 1922). Indeed, Bel Geddes' musical concept was far from the ordinary and would have presented a big challenge for any composer at his time. Apparently, Igor Stravinsky was, according to Bel Geddes' friend Leopold Stokowski, 'most interested and could make an extraordinary work out of this' (Geddes, 1960, p. 251).

The stage lighting was another important element in the production of *The Divine Comedy*. It was supposed to vary every moment of the action, in order to increase the impression of distances and space, and also to express the emotional beauty of the plot. Bel Geddes attempted to create this emotional quality of the scenes through rich variations of light intensity, color, and mobility. To bring the action to its climax through the peak of light, he planned to have a series of twenty immense gauzes emerge from each of the upper twenty steps of the stage-model during the final episode (Cheney, 1922). This variety of lighting design and movements complemented the set with passion and liveliness, and was supposed to create enormous shadows and monstrous shapes, sometimes covering the stage

with radiant light in the most dramatic moments of the play. It should be noted that despite all the complexity of his ideas for lighting design, Norman Bel Geddes never required additional rehearsals for other productions he staged to investigate this aspect alone. This happened mainly due to his 'intense pre-planning of all the elements of a production, and especially of the lighting, evident in the elaborate and voluminous artifacts and promptscripts for the productions he directed' (Bogusch, 1972, p. 421).

This study argues that the main conceptual idea of *The Divine Comedy* project was the unification of all of the abovementioned elements. There is little doubt that the technological solution for staging *The Divine Comedy* suggested by Norman Bel Geddes, was far too advanced for his time. Thus it has only resulted in a detailed, full-scale, wooden stage-model, which, through the use of lighting and photography by Francis Bruguière, illustrated precisely every change of scene and every alternate minute of the production.

### 5.3 The Set-Model

'Model theatres fall into two basic types: physical (usually wooden) and virtual (computer-generated). Both types depend upon the existence of drawings of the theatres, scenery, and theatrical machinery.'

(Mohler, 1999, p. 418)

Norman Bel Geddes created a stage-model that would address all the necessary dramatic requirements of Dante's story without any additional scenery. Some of the main drawings developed from small sketches (approximately three inches in diameter) to a bigger size (twenty-four by twenty inches) more detailed drafts. Bel Geddes produced eight water colors and numerous red and black chalk renderings of various scenes throughout the production (Fig. 13); however, all perspective



drawings were concerned with the most accomplished part of the project – *The Inferno*.

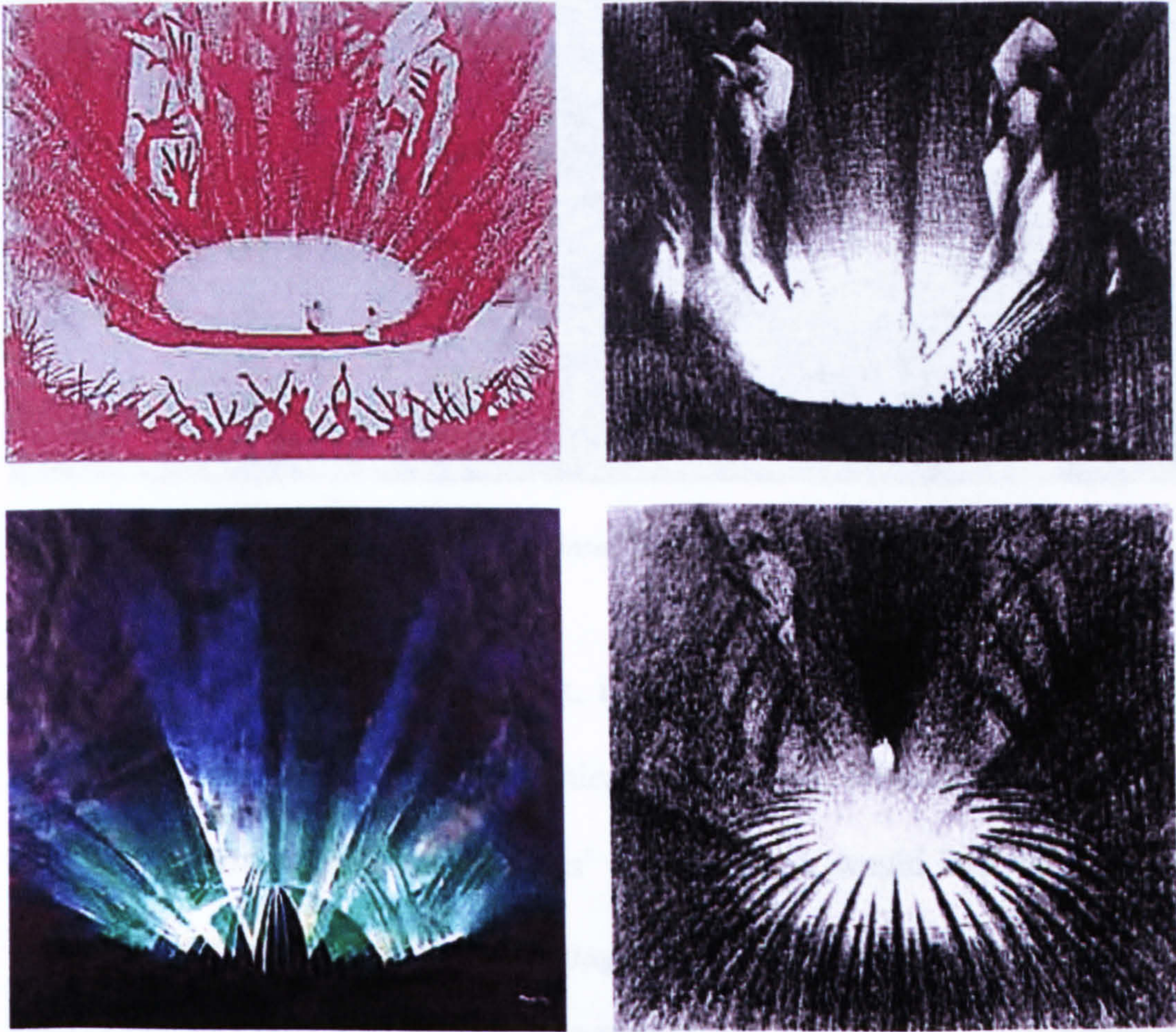


FIGURE 13: Norman Bel Geddes, sketches for the production of *The Divine Comedy* by Dante Alighieri, 1921; high-resolution digital photographs of the originals. Source: The HRC, the University of Texas in Austin

There is little doubt that one might find some resemblance between the above sketches and, for example, the German expressionistic tendencies in filmmaking of the early twentieth century, or Gustav Doré's illustrations for Dante's *Inferno* (1861), or even the 1880 painting by Swiss symbolist Arnold Böcklin – *Die Toteninsel* (Fig. 14). Nevertheless, there is no hard evidence supporting such visual influences on Norman Bel Geddes' vision of *The Divine Comedy* set-concept.





Figure 14: Arnold Böcklin (1880) *Die Toteninsel*. Source: <http://en.wikipedia.org/>

At an early stage of the design work, it became evident that the stage's general shape would be a simple and economical construction, resembling the shape of a classical amphitheatre. In Bel Geddes' own words, it would look like a crater in the earth or 'the fiery crater of the stage design' (Hunter, 1966, p. 236). Young (1951) described the design as being full of planes, lines, and masses, whilst at the same time being infinitely delicate, varied and also breathing and vibrating. The author developed several construction drawings specifically for the model (which was a twenty-fourth of full size) not the real set. The plan for it was prepared with an eight-inch scale (Fig. 15), to be subsequently reworked to the working drawings (Fig. 16). The main difference between the early sketches and later elevations was the height of the upper towers, which was reduced in order to fit the whole stage inside the indoor-area of the theatre building.

Figure 15: The working drawings of the set for *The Doctor's Dilemma* by Norval H. Geddes. Source: The HRC, the University of Texas at Austin



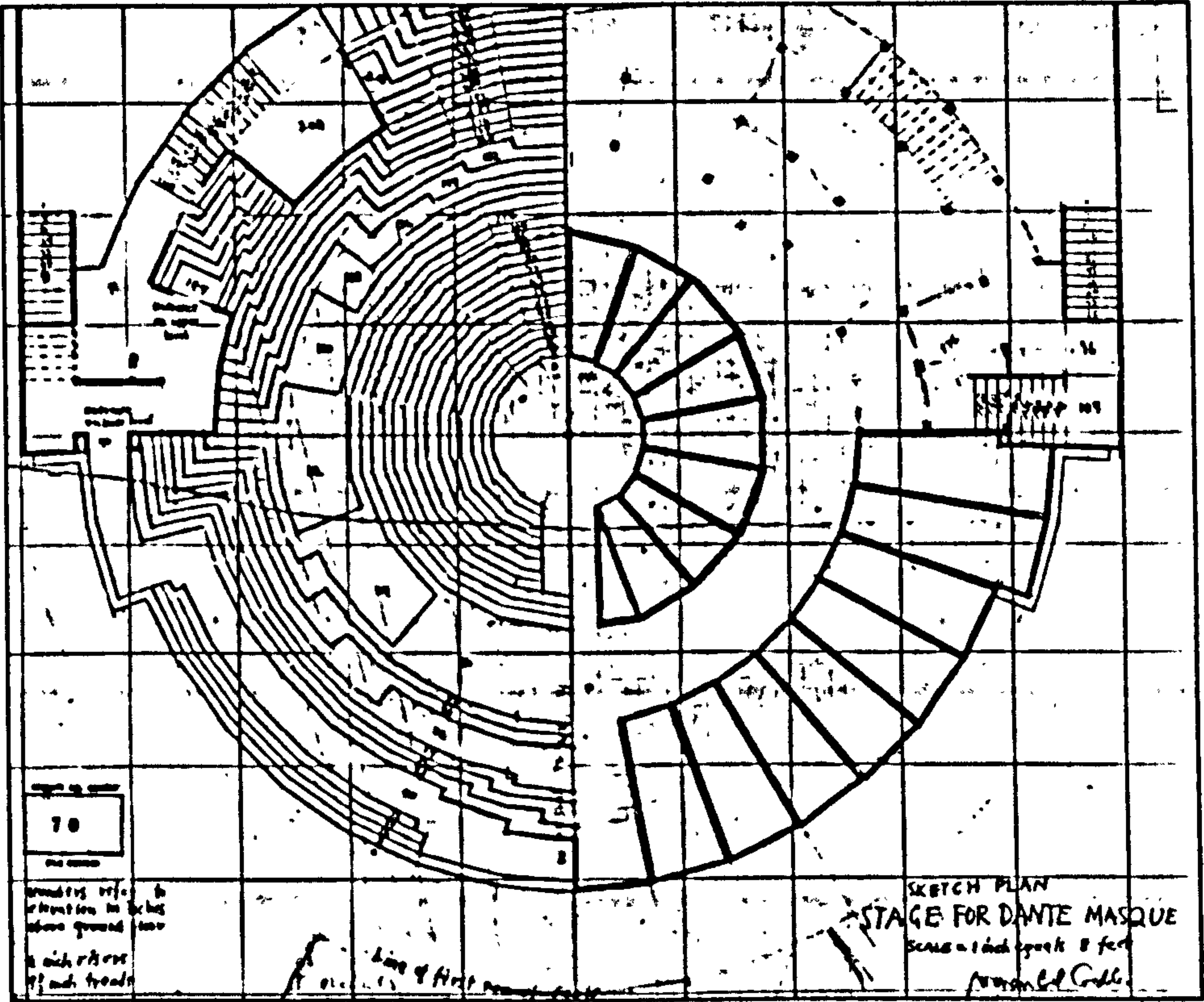


FIGURE 15: The Sketch Plan of *The Divine Comedy* set by Norman Bel Geddes; low-resolution scan. Source: The HRC, the University of Texas in Austin

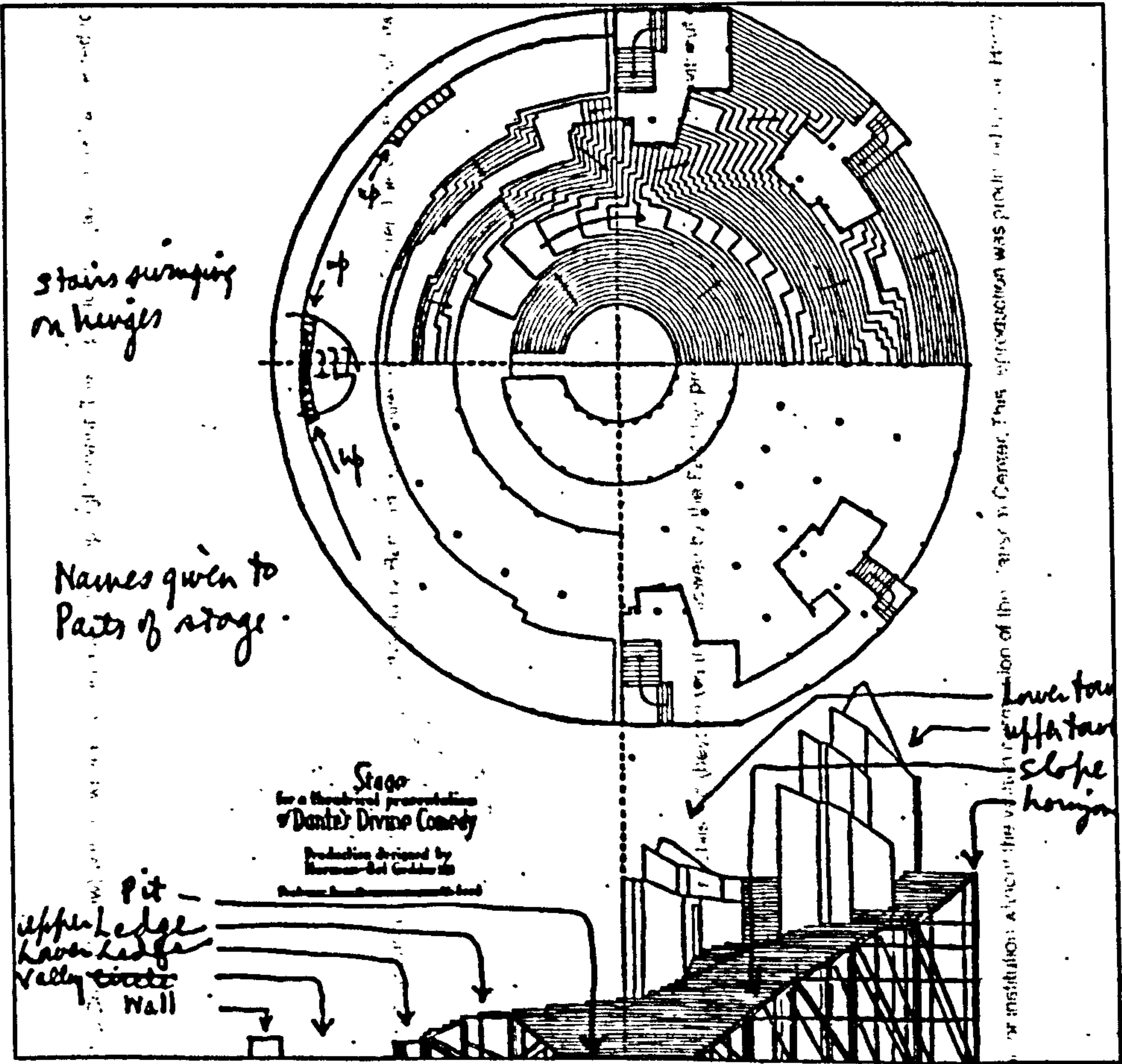


FIGURE 16: The working drawings of the set for *The Divine Comedy* by Norman Bel Geddes; low-resolution scan. Source: The HRC, the University of Texas in Austin

Bel Geddes' model of *The Divine Comedy* set pictured a circular stage, formed by numerous layers that create stepped slopes and a central pit. On the far side, the slopes were designed to ascend from the pit to a maximum height of fifty feet, if built in real life; whilst at the near side of the pit was a twelve-foot ledge, descending towards the audience seats (Fig. 17). The ledge formed a series of terraces, and terminated in a valley at the bottom of the pit, running half way around the circle. The valley was separated from the audience, which would have sat in a half-circle facing the orchestra, as in a Greek theatre, by a solid wall (Young, 1951). The stage-model was built with all details, including means for entrance and exit, in order to be recreated rapidly in the real theatre.

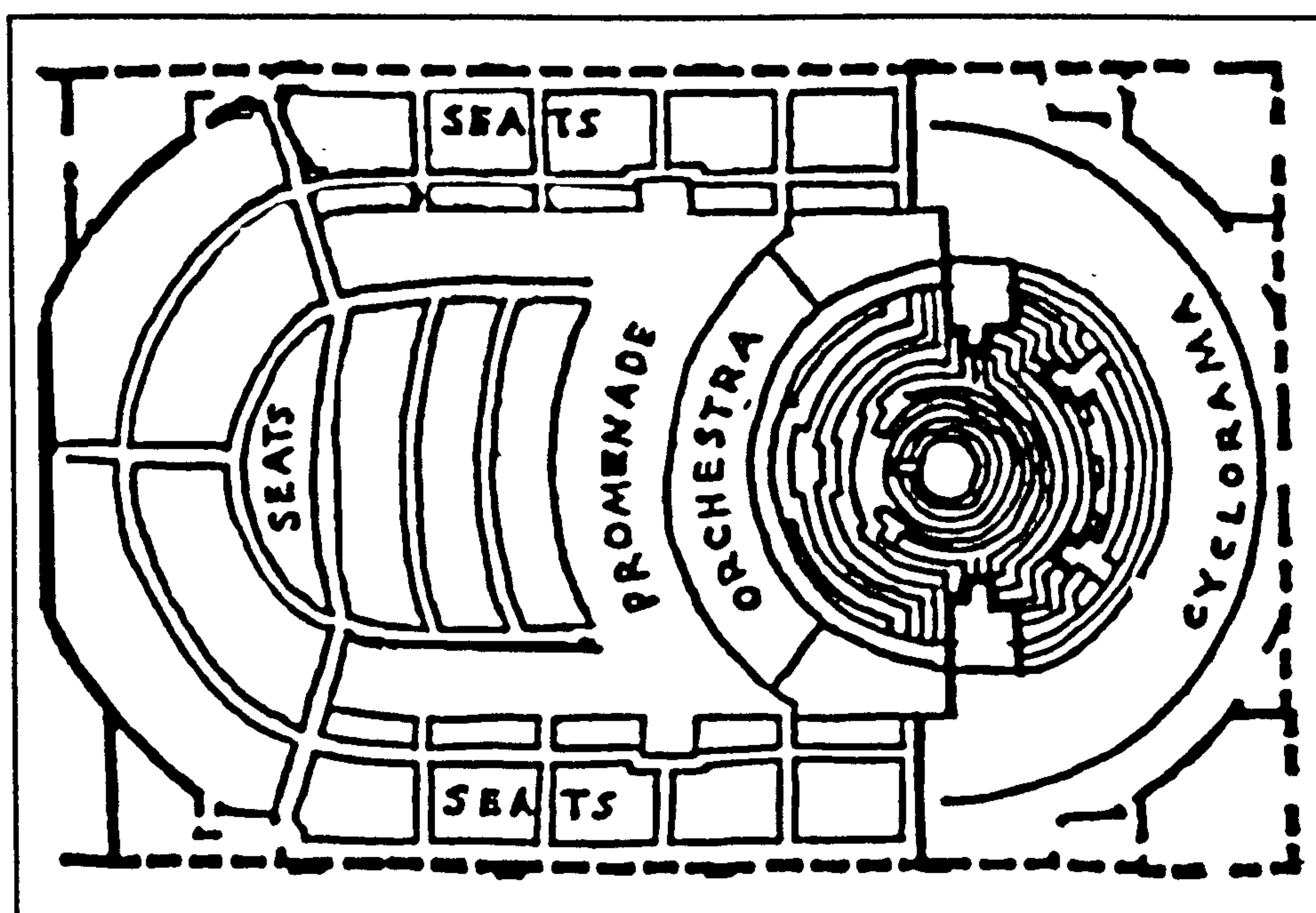


FIGURE 17: Plan of the proposed arrangement of seats and stage for Norman Bel Geddes' production of *The Divine Comedy*, low-resolution scan. Source: The HRC, the University of Texas in Austin

The real set-construction would have measured 135 feet by 165 feet. From the inside, it was supposed to be composed of swinging doors, which allowed people to pass through the whole stage or reach the top of the four towers rising from the slope in a series of stepped levels. Beneath the stage slopes Bel Geddes planned to



accommodate several assembly rooms, each with a capacity of two hundred people. Each of the rooms would have been adjoined with special space for costumes and properties, and three large vibrating chambers for the magnification of sound waves. Every assembly space would also have been connected with the pit, towers and other portions of the stage by means of several passageways and stairways (see Geddes, 1960, pp. 247-253).

After the set-model was fully constructed, a professional photographer Francis Bruguière took sixty black and white pictures of the model (Fig. 18) equipped with plaster figures of the actors and correct illumination, which was arranged according to the intended plot. The description of the plates and some other photographs found during my research trip to the HRC at the University of Texas in Austin are provided in Appendix Seven of this thesis.

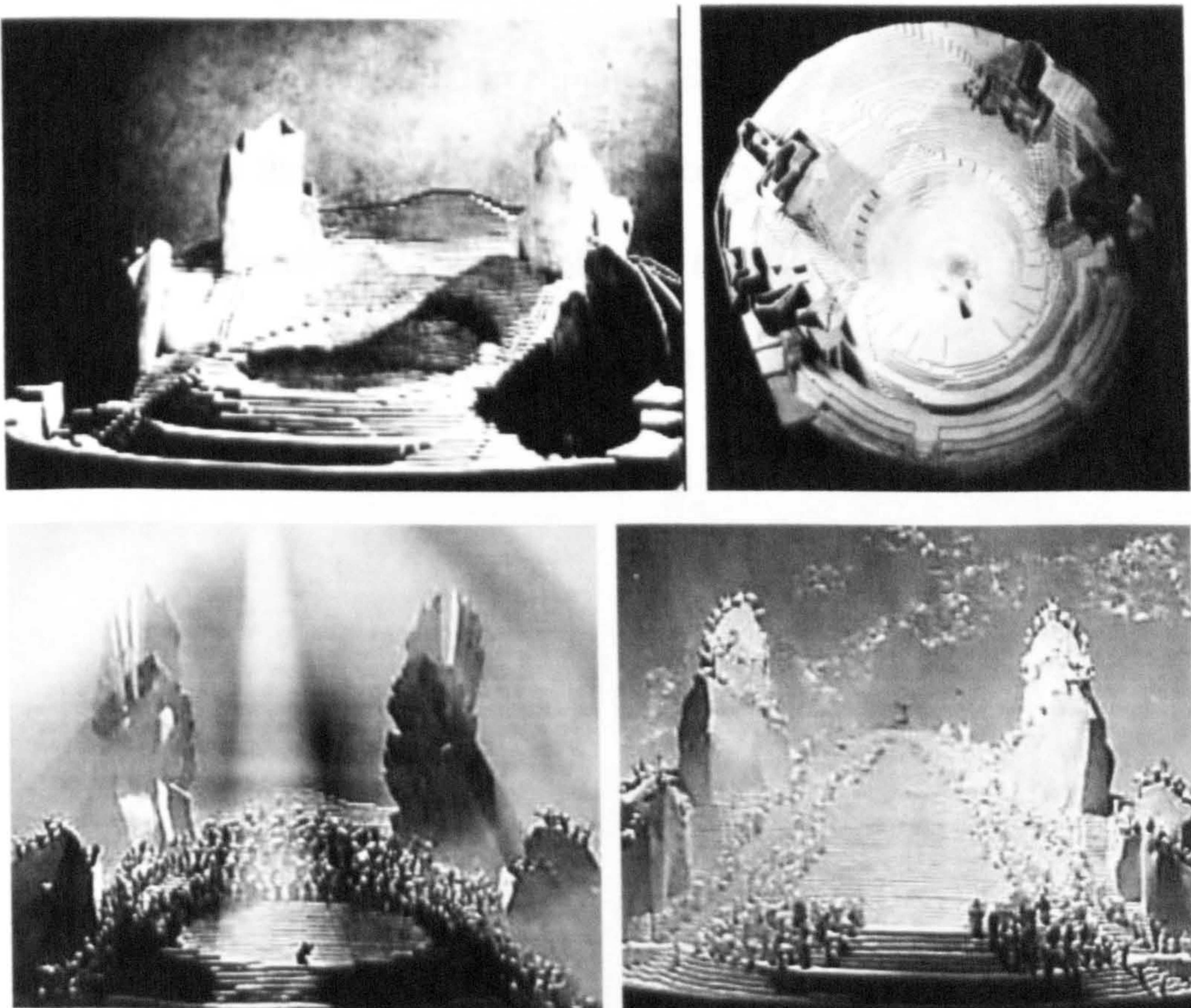
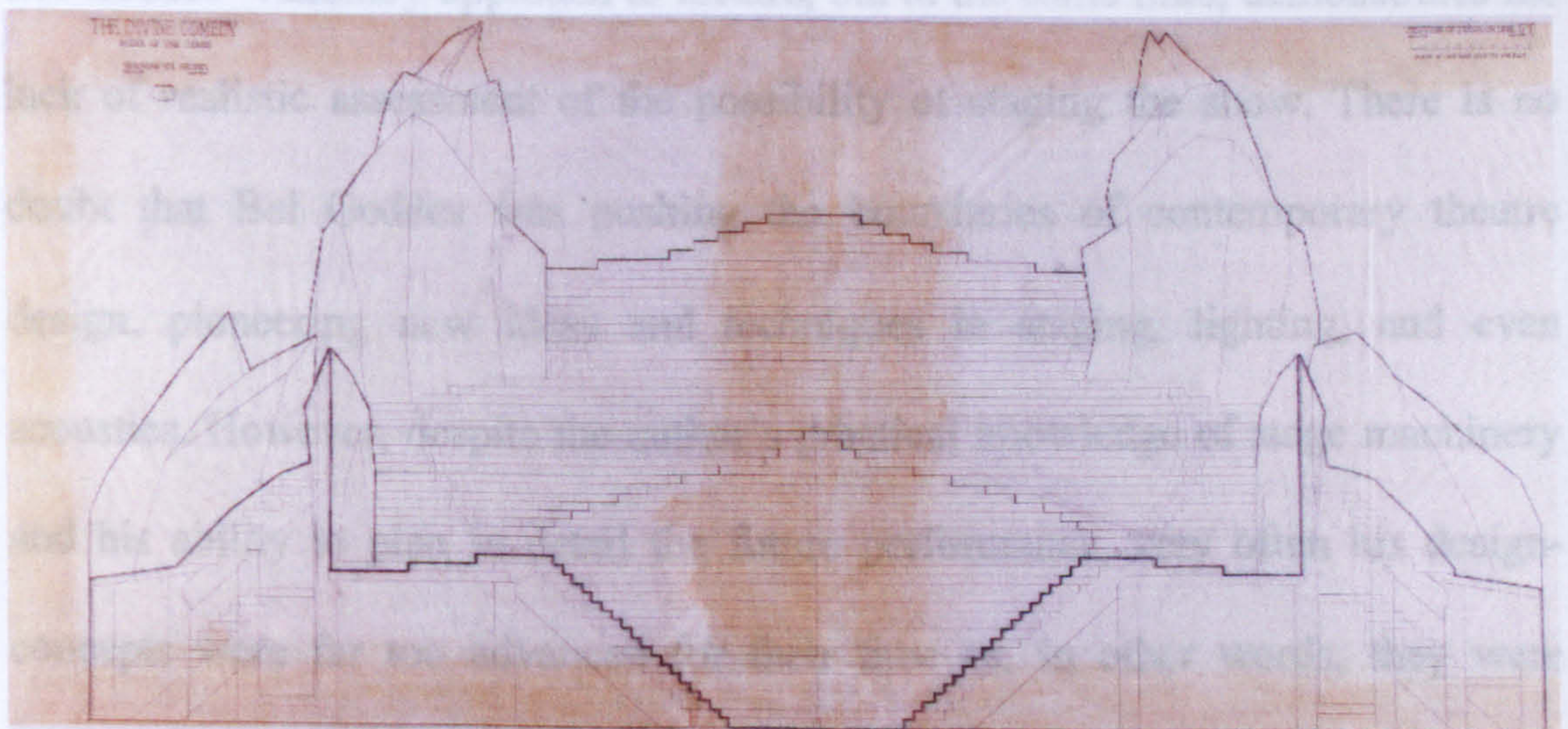


FIGURE 18: Francis Bruguière's model photography for the production of *The Divine Comedy* by Dante, low-resolution scans. Source: The HRC, the University of Texas in Austin.



These photographs, together with Bel Geddes' original sketches and plans, are the only visualization of *The Divine Comedy* project that exists today. Unfortunately, they could only give a hint of the grandiose ideas of the author and his ambitious plans for this production, without expressing them fully. As mentioned in the introduction, the original set-model was lost several decades ago. This research reveals that, unfortunately, there is no evidence about what happened to it; however, it is possible that Norman Bel Geddes himself discarded it. He photographed the set-model extensively, which was, on the one hand, typical for him but, on the other hand, might have indicated that he had no intention to keep it.

Extraordinary enough, while I was writing this chapter, seven more original drawings by Norman Bel Geddes (two of them are shown in Figure 19) were accidentally discovered by Helen Adair, the Associate Curator of Performing Arts, at the HRC in summer 2006. These sketches explain the inside construction of the staircases, which connect various parts of the stage, enabling the actors to move freely within the set structure. There is very little chance, however, that the original set-model will be also found sometime in the future.





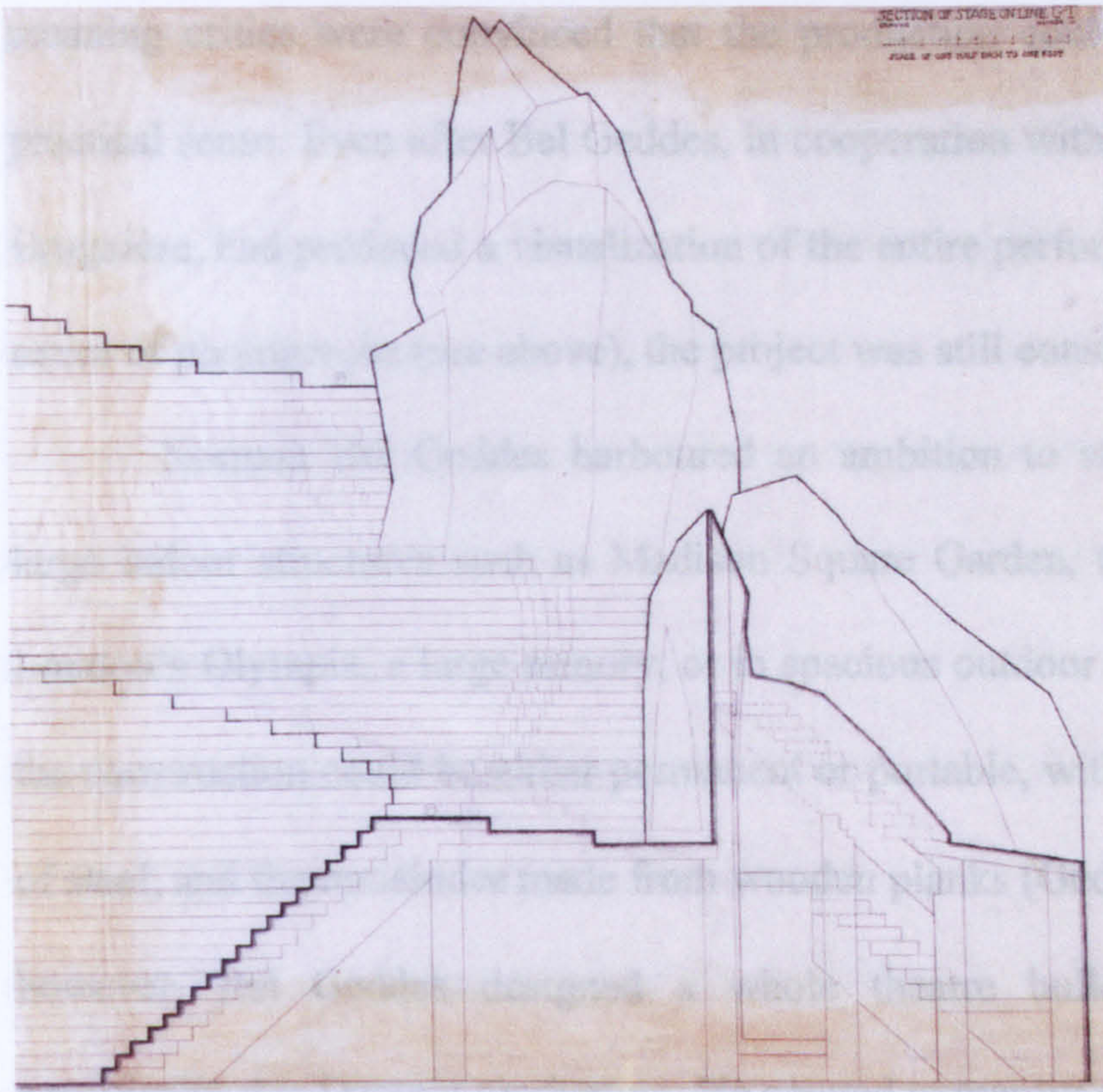


FIGURE 19: Recently found drawings for *The Divine Comedy* by Norman Bel Geddes; high-resolution digital photographs of the originals. Source: The HRC, the University of Texas in Austin

#### 5.4 The Limitations and New Reality

This study argues that the whole production of *The Divine Comedy* could be regarded as an entirely new type of stage design. The project exemplifies Norman Bel Geddes' visionary approach to theatre, but at the same time, demonstrates his lack of realistic assessment of the possibility of staging the show. There is no doubt that Bel Geddes was pushing the boundaries of contemporary theatre design, pioneering new ideas and techniques in staging, lighting, and even acoustics. However, despite the author's practical knowledge of stage machinery and his ability to plan in detail the future performance, very often his design-concepts were far too advanced for their time or, in other words, they were beyond the realms of feasibility. In the case of *The Divine Comedy*, even well-



meaning critics were convinced that the production could not be realized in a practical sense. Even after Bel Geddes, in cooperation with his pupils and Francis Bruguière, had produced a visualization of the entire performance in the form of a series of photographs (see above), the project was still considered impractical.

Norman Bel Geddes harboured an ambition to stage the play in either large indoor structures such as Madison Square Garden, the Chicago Coliseum, London's Olympia, a large armory, or in spacious outdoor sites. He specified that the construction could be either permanent or portable, with the main frame made of steel, and the remainder made from wooden planks (Geddes, 1924). At the end, however, Bel Geddes designed a whole theatre building to accommodate specifically this Dante's production. He created numerous architectural plans for a whole series of innovative theatre buildings, which he called the *Six Theatres Project* – one of them was *The Divine Comedy* theatre complex. The main purpose of this project was to establish a radically new relationship between the audience, stage and onstage action. Bel Geddes planned the general shape of the building in perfect dome geometry, in order to be in harmony with the circular stage, but also to keep the audience in a 'sound capsule'. For this purpose, the under-stage sound chambers were intended to produce various abstract sounds, magnify them to the desired intensity, and then release them through one or all of nine tubes, situated in each of four towers of the set. Additional sound-tubes were supposed to be placed at the bottom of the pit, below the spectators' seats, in the rear, and directly overhead in the centre of the auditorium (Geddes, 1933, pp. 761-769).

To explore whether the creation of such a sound capsule was possible, I approached a well-known Austin architect, Marley Porter, who is interested in



architectural works by Norman Bel Geddes (correspondence: May 2006). The result of this informal online questionnaire (Appendix Eight) was rather surprising. Marley Porter, after careful examination of *The Divine Comedy* theatre and the set-model plans, was convinced that the acoustics of the building itself, as well as the fitted inside stage, would have been very poor; partly, because of the height and the domed shape of the building, which is ‘one of the worst in directing sound’, and, essentially, due to the circular stage design, which ‘reflects sound waves back into a focal point.’ Indeed, it was not the first criticism of Norman Bel Geddes’ architectural endeavors. His designs of theatre buildings were deeply analyzed by such architecture scholars as George C. Izenour and later Iain Mackintosh, who argued that the role of the stage designer in theatre architecture can be hardly defined as positive. In his 1993 book *Architecture, Actor and Audience*, Iain Mackintosh wrote:

To the theatre historian, it is fascinating to see how a scene designer can propose superficially seductive architectural designs which, had they been built, would have failed and would have reduced his reputation. However, precisely because none of them ever was built, yet they were everlastingly reproduced, the Bel Geddes theatres became the theatrical equivalent of Corbusier’s high-rise *La Ville Radieuse*, the inspiration of a hundred third-rate imitations.

(pp. 47-48)

The above analysis clearly indicates that, despite its aesthetical appeal and visionary technology, there were some major shortcomings in the project of *The Divine Comedy*, which would have possibly hampered any attempt to stage the performance.

Indeed, there were some complications with sound, already mentioned above, but also with lighting design and especially with the main light coming

from the central pit. According to Hunter (1966), it would be difficult to reproduce this type of illumination precisely, as indicated in Bruguière's photographs, considering that only low-kilowatt lighting equipment was available in 1921. Additionally, the grand scale of the stage and especially the height of the towers would have necessitated attaching parts of the lighting equipment to the ceiling (more than 135 feet above the stage), resulting in the very weak illumination of the set. Moreover, Bel Geddes intended to vary the light every moment of the performance, implying a full flexibility of its navigation and control, which would have been very difficult (if not impossible) to achieve, using the technological devices that were available at the beginning of the twentieth century.

Although all Bel Geddes' efforts triggered more interest in *The Divine Comedy* project than anything else he had ever done, their only outcome was a published book, largely consisting of Bruguière's photographs. It was hardly surprising, because after considering the intended size of the stage, complicated lighting and sound mechanisms, assembling and especially transporting the production set, this study is convinced that all these would have definitely caused many major technical and logistical problems, not to mention prohibitive costs.

## 5.5 Digital Reconstruction

Further inconsistencies in the stage construction could have been revealed only by digitally reconstructing the set-model. For this purpose, the most detailed Bel Geddes' stage plan was transported into AutoCAD 2002 program, in order to create, literally step-by-step, its 3D extruded version (Fig. 20).



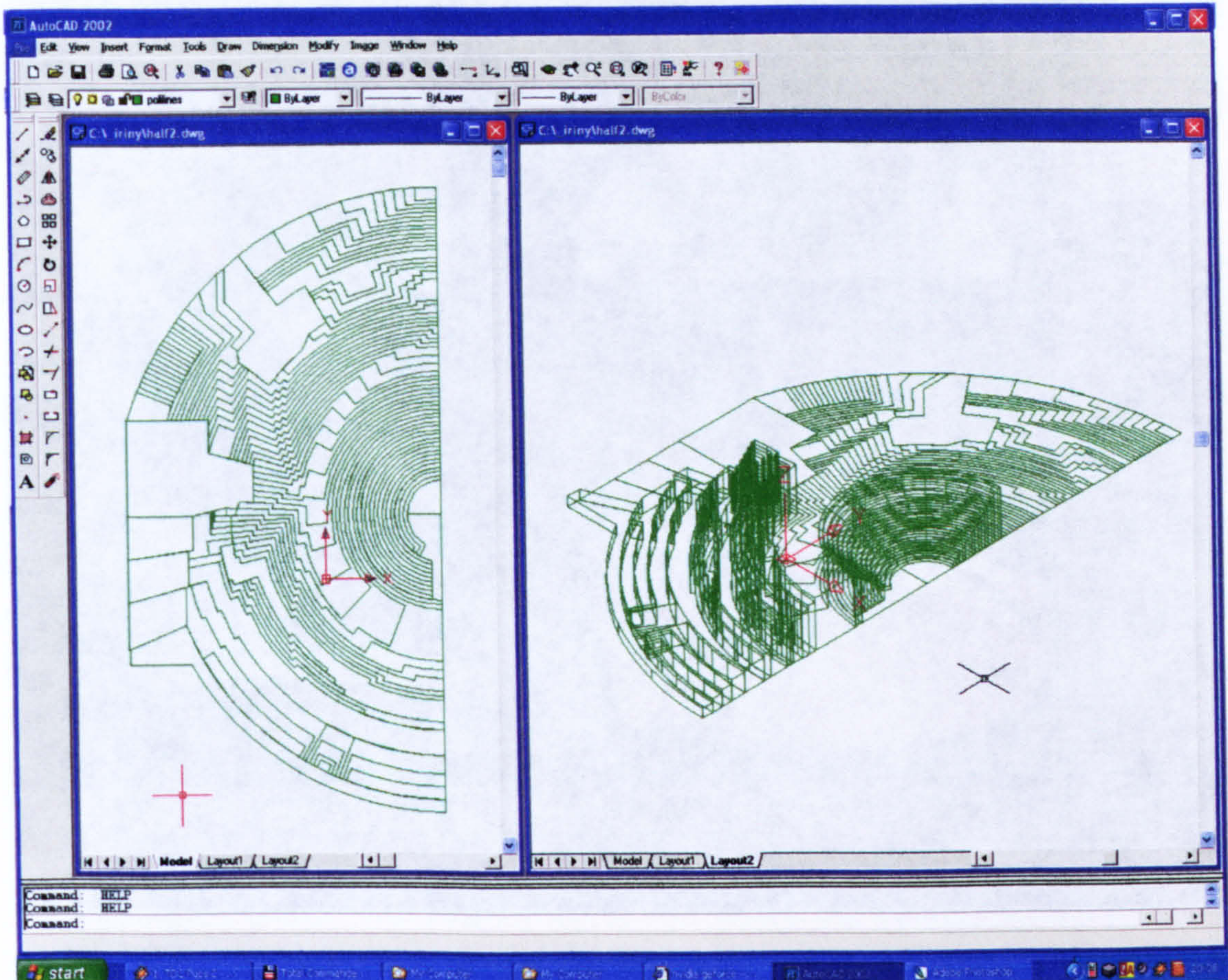


FIGURE 20: The process of 3D extruding in AutoCAD 2002. Authors: Iryna Kuksa and Eugeniya Kareva

Gradually, the whole stage was extruded from the 2D plan, leaving only four towers with the steps leading to them to be reconstructed in 3D Studio Max 7 (Fig. 21). The reason for this was their over-complicated shape, which required employment of the ultimate in professional 3D tools for more exhaustive modelling.



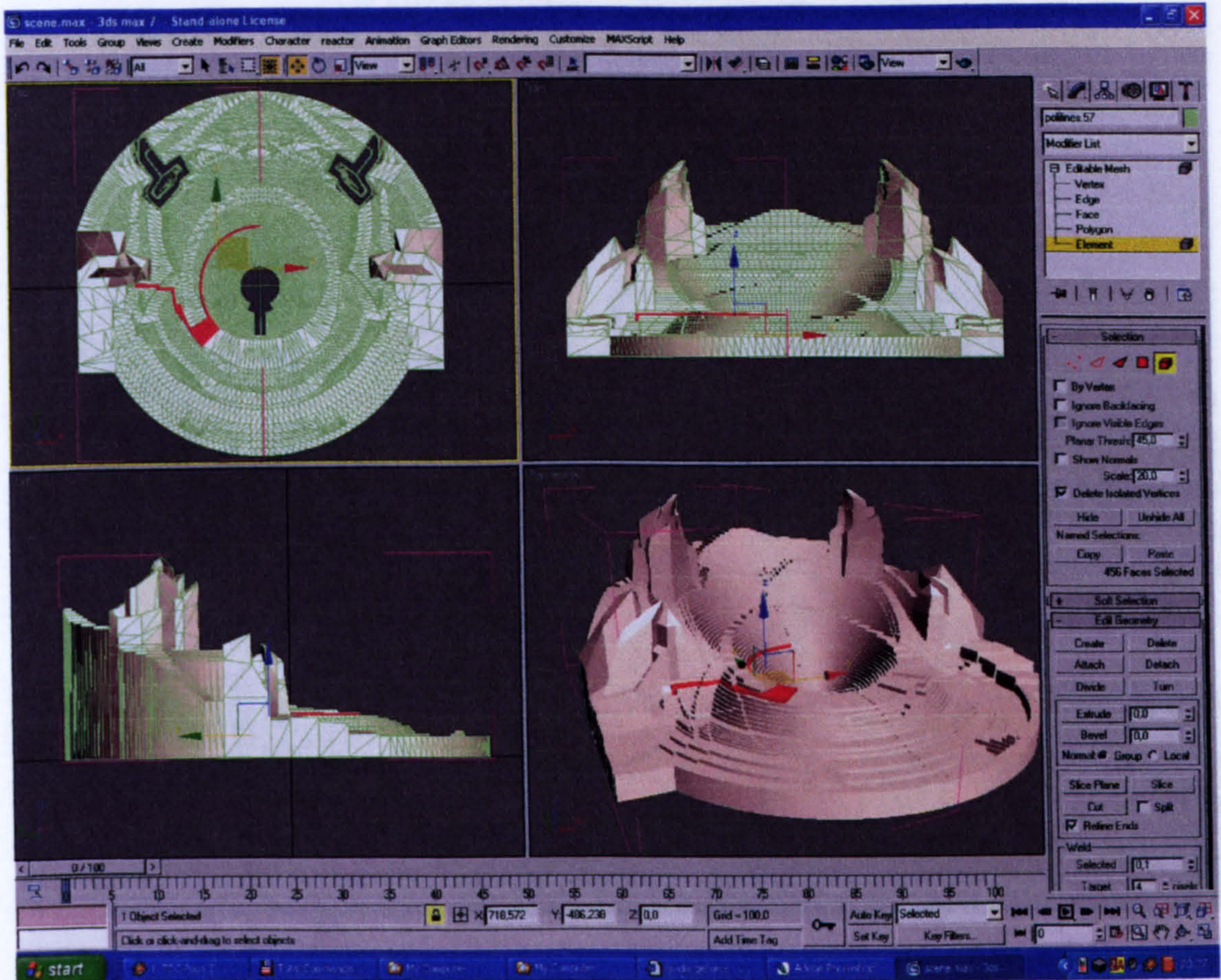


FIGURE 21: The process of 3D modelling in Discreet 3D Studio Max 7. Authors: Iryna Kuksa and Eugeniya Kareva

The precision of Bel Geddes' drawings and plans enabled the construction of an accurate computer model (Fig. 22), which to date, is the most exact replica of what the real stage would have looked like. Unfortunately, the absence of the original side elevation of the stage and the lack of information on the construction of the towers, each of which, ideally, should have had a detailed explanation (i.e. plans and construction drawings) led to some difficulties during the modelling process.



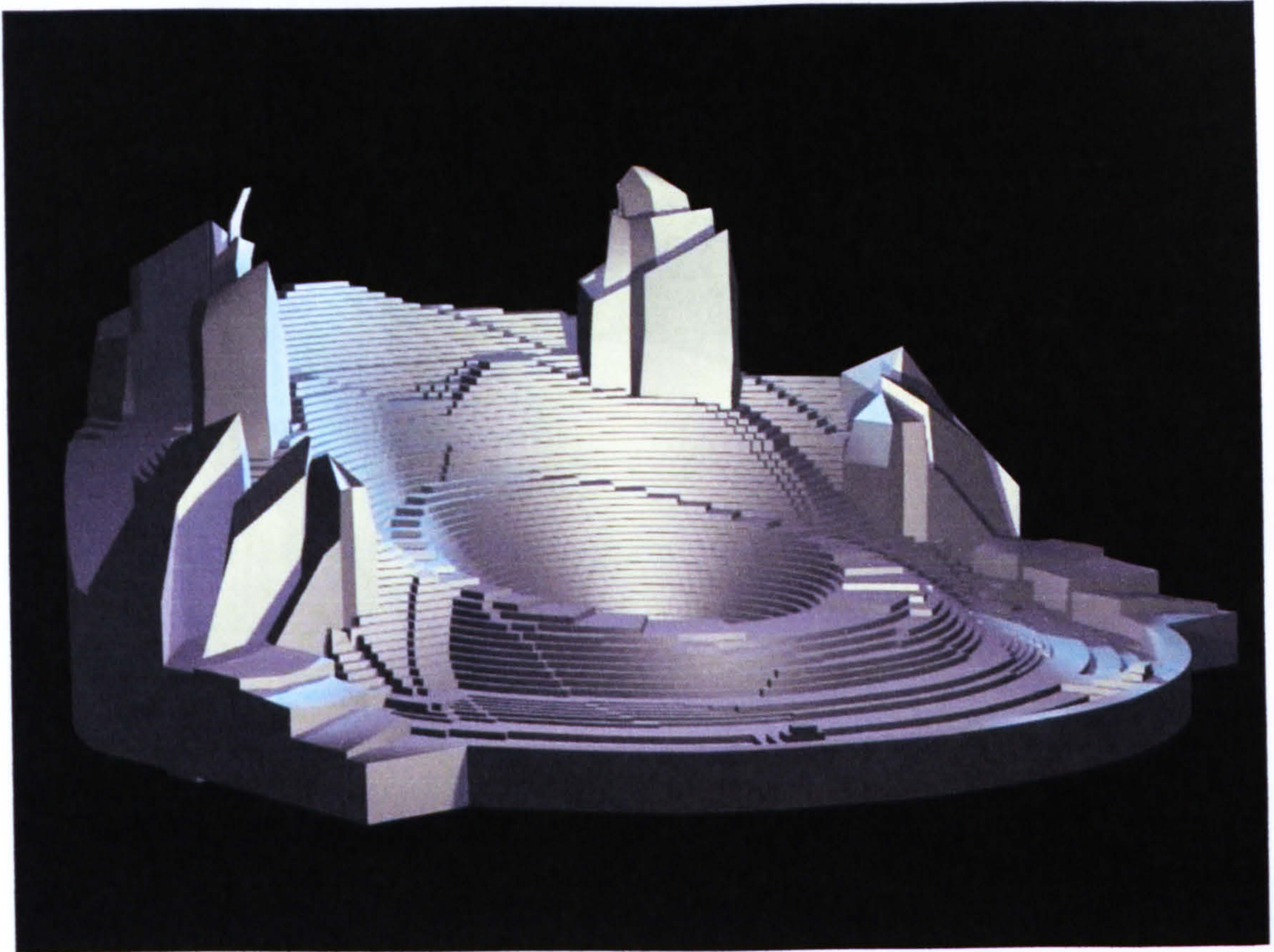


FIGURE 22: Discreet 3D Studio Max 7 reconstruction of *The Divine Comedy* stage-model (3D modelling). Authors: Iryna Kuksa and Eugeniya Kareva

Norman Bel Geddes projected the front elevation of the set from perspective drawings, as opposed to the usual development from architectural plans, which, as this study argues, might have caused some misalignments of structures, as illustrated in Figure 23. This indicates that, although in general the original elevations are precise, there are slight inconsistencies, including the height of the front right tower, minor distortions of the shape of all four towers, and the width of the front steps of the set. Here, the white lines represent the original Bel Geddes' elevations, layered upon the 3D reconstruction. It should be noted, however, that these mistakes would not have significantly affected the overall structure of the stage and, importantly, its functionality.







The late, but important, discovery of the additional Bel Geddes' drawings for the production, revealing the inside construction of the staircases, further confirmed a high level of precision in the 3D model. The only inconsistencies illustrated in Figure 24 have been discussed previously.

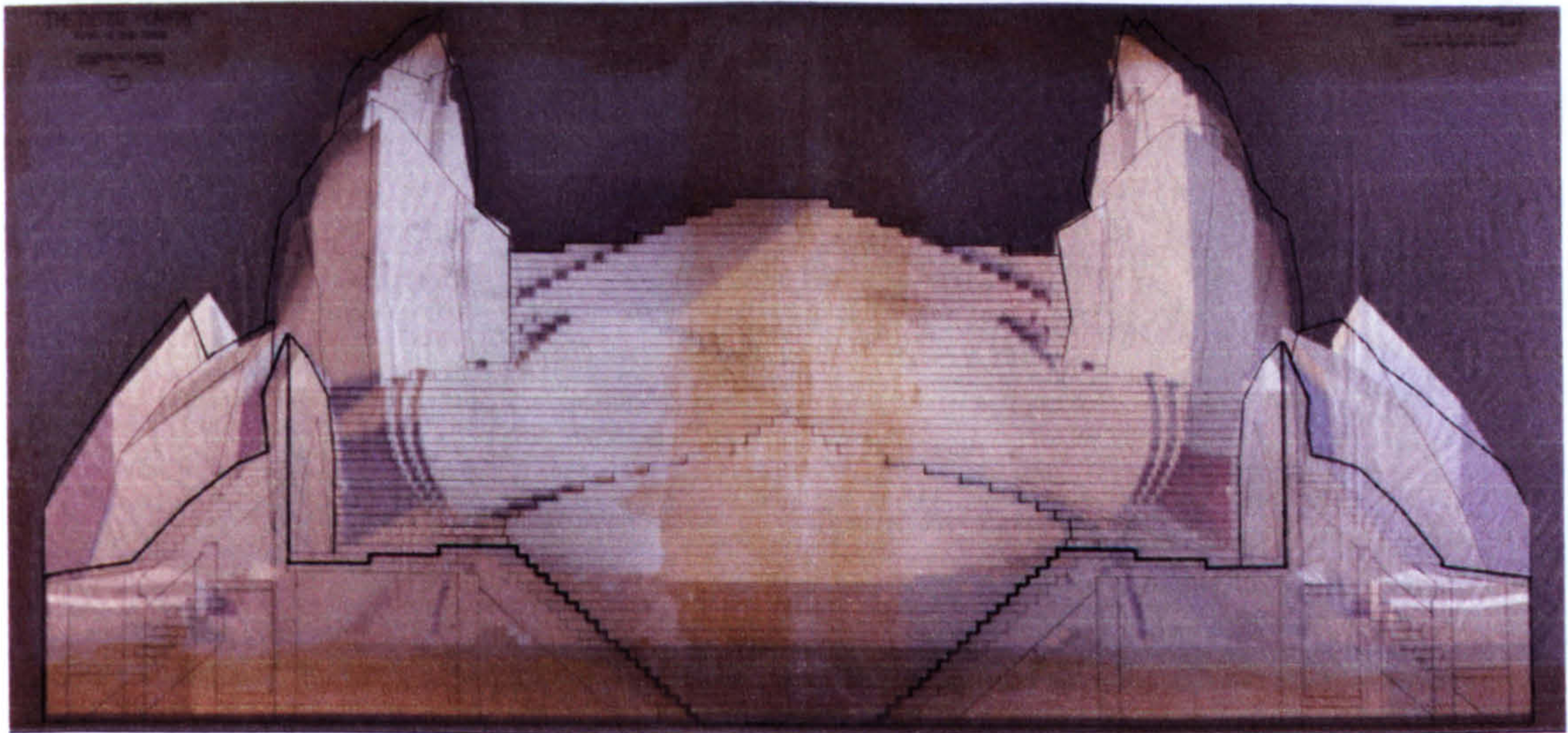


FIGURE 24: The inside construction of the staircases (original rendering by Norman Bel Geddes) overlaid on the 3D reconstruction. Authors: Iryna Kuksa and Eugeniya Kareva

After the digital set-model was reconstructed completely, the next step was choosing the material and texture of the construction and the setup of the stage-illumination. In order to create eye-catching visual effects using the original model photography of Francis Bruguière as an example, it was decided to apply light colors and smooth texture on the set-model. Such a choice was made for ease in creating the dramatic atmosphere, by experimenting with directional and spot lights, to emphasize the uniqueness of the stage construction by generating deep shadows. All the work was conducted in Discreet 3D Studio Max using three different viewpoint renderers, this time not only to display geometry, but also the variations of light sources and their effect on the form of the set (Fig. 25, 26).



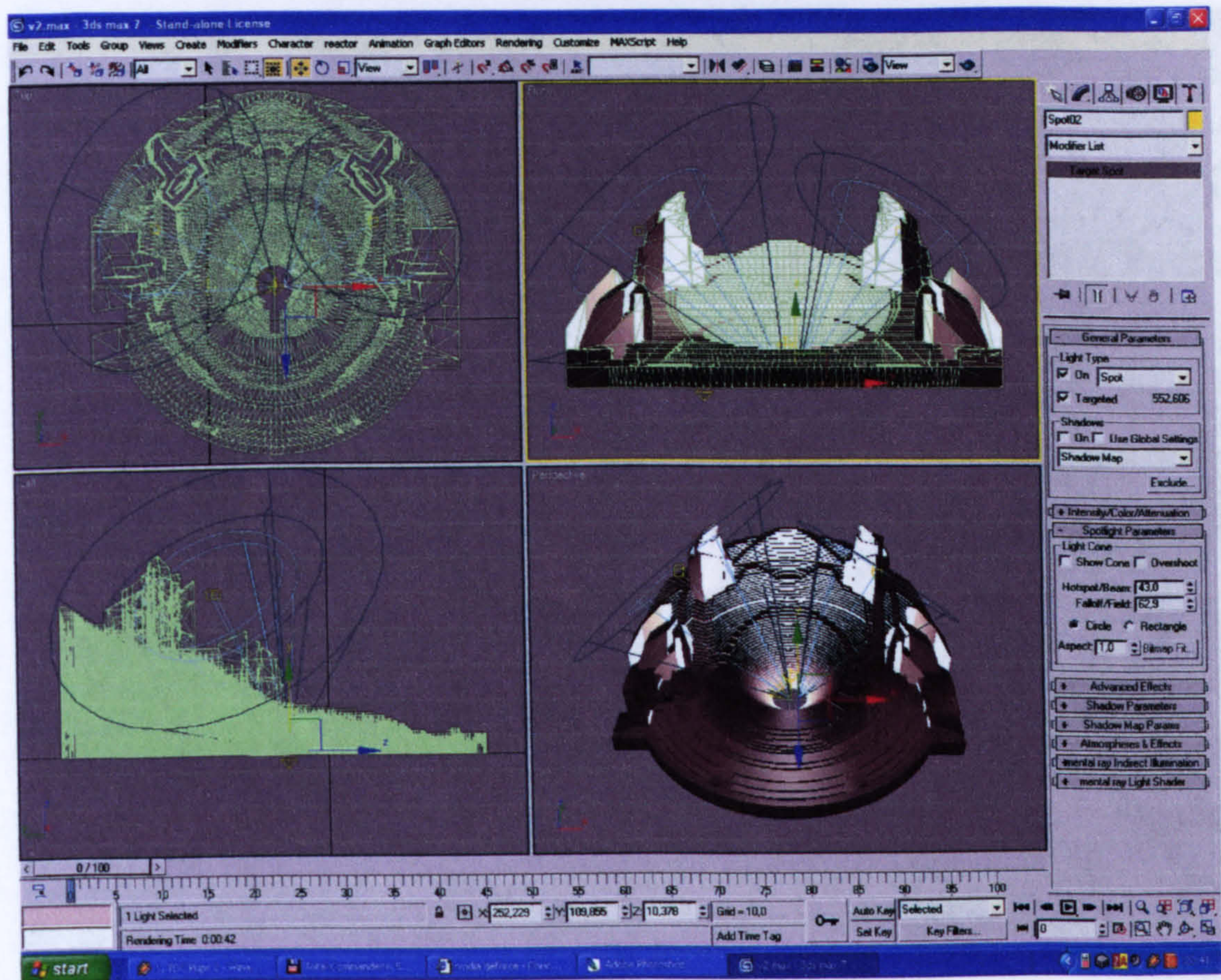
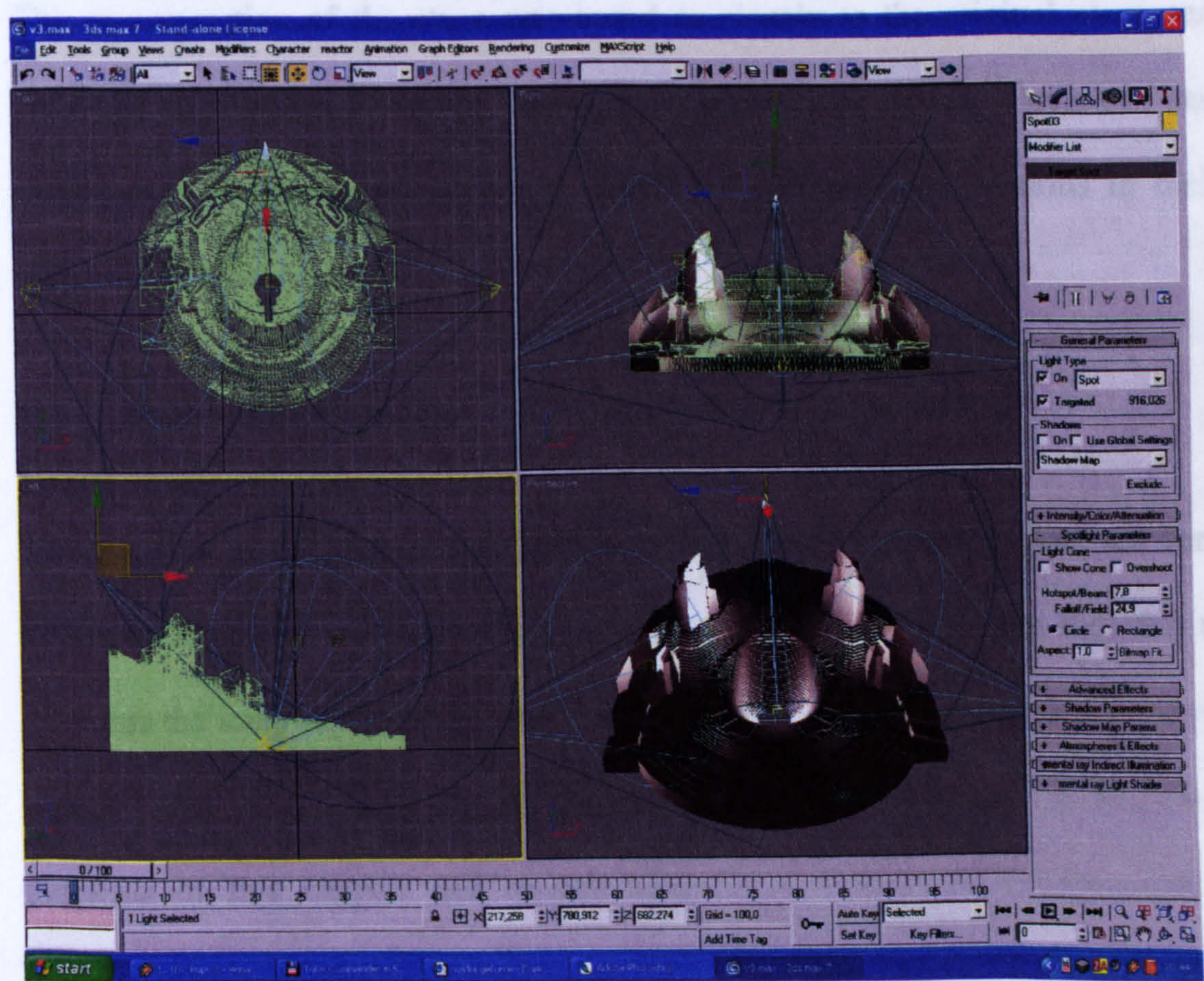


FIGURE 25: Positioning of the light (example one) using Discreet 3D Studio Max. Authors: Iryna

Kuksa and Eugeniya Kareva





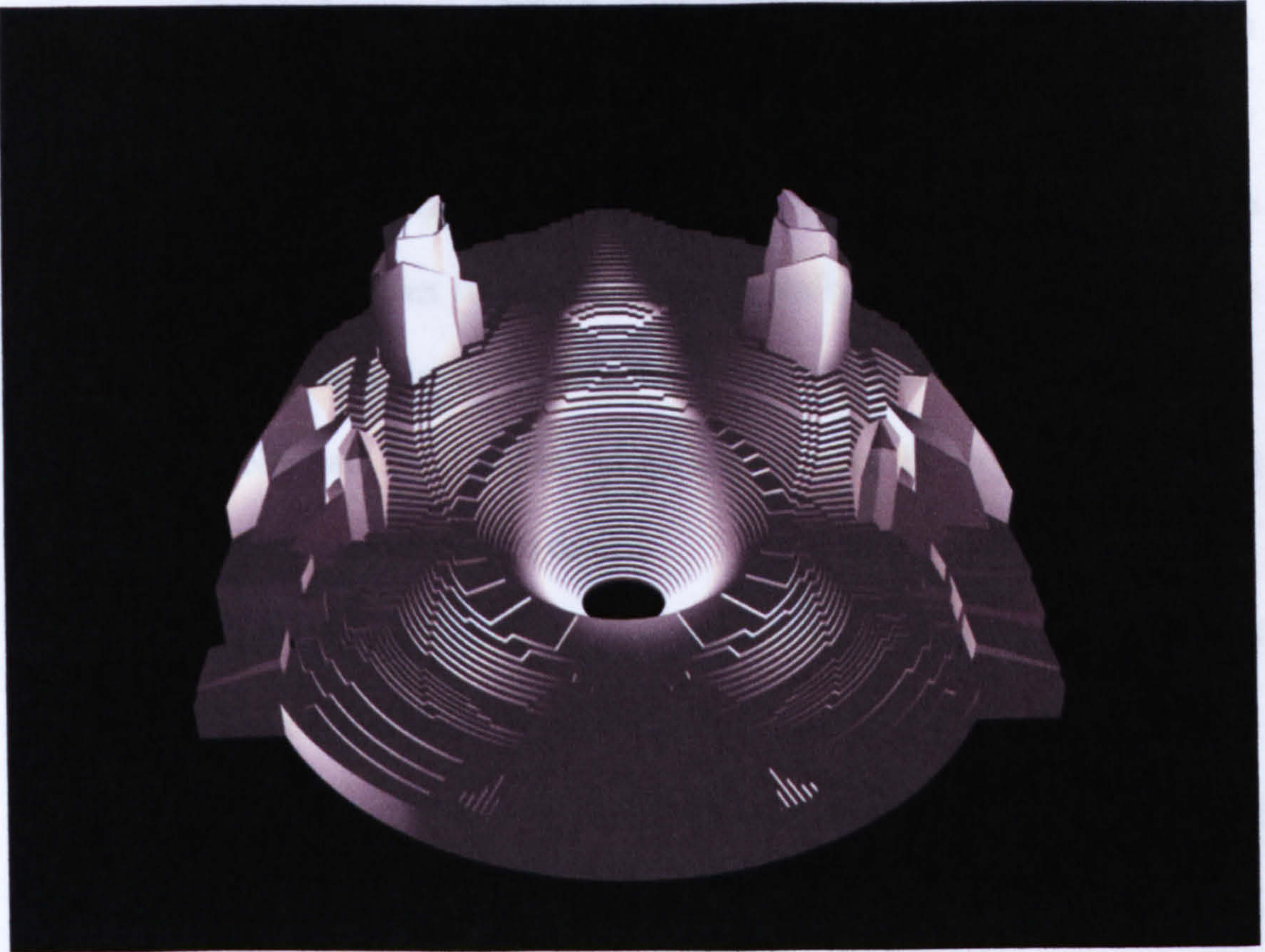


FIGURE 26: Positioning of the light (example two) using Discreet 3D Studio Max. Authors: Iryna Kuksa and Eugeniya Kareva

The reconstruction of the stage was based as closely to the original plans and drawings as possible. However, due to an apparent lack of side elevations and explanation of the tower's structure, some insignificant modifications in their shape might have occurred.

## 5.6 Concluding Remarks

There is little doubt that 2D renderings of *The Divine Comedy* project are very important historical artefacts. However, their major drawback is that they fail to visualize the unity of the stage, which was the main aim of the production, not to mention the 'wow' factor the author wished to create. Thus one of the main purposes of this chapter and overall study is to contribute to the existing knowledgebase by digitally reconstructing Bel Geddes' original set-model, using



the available primary sources. The intention here is to give the viewers an opportunity to appreciate fully one of the finest examples of the twentieth century unrealized modernist stage design, by viewing its unique construction interactively in 3D. Another major reason for digitally ‘reviving’ the production of *The Divine Comedy* is to revoke the long-lost interest of the academic community in Norman Bel Geddes’ ideas and designs, in an attempt to fill a glaring gap in the history of theatre design.

This study attempts to prove that without this visionary design by Bel Geddes, the modern evolution of performance space in the USA, and possibly Europe, would not have been possible. This highly-ambitious theatrical project aimed to unify theatre space through the organic synthesis of visual elements, performance and advanced technological innovations. The design was grand, technologically sophisticated, and well-advanced for its time. The author of the project, mainly due to his obstinacy, was unwilling to consider any alternatives to his original plans for stage machinery, lighting, sound or even the action sequence without first attempting to test his own visualizations, meaning that ‘the artifacts of his vision created over a period of thirty years are fairly faithful guides to the production of the plays and dramatic spectacles which he designed for theatrical presentation’ (Hunter, 1966, p. 245). On the other hand, however, this lack of flexibility was probably one of the main reasons why *The Divine Comedy* has never been staged. Despite the fact that back in April, 1924 a visionary of European stage design, Gordon Craig, announced that this production could be fully realized, it is obvious that even nowadays it would require immense efforts and resources to stage the play following Bel Geddes’ original ideas and directions. This practice-based study was the first to visualize this ambitious set



design in 3D for educational and research purposes. Some of the conclusions made here will play a critical role in my original educational project – the Set-SPECTRUM – presented in the following chapters.



## CHAPTER SIX: THE SET-SPECTRUM PROJECT – A NEW EDUCATIONAL APPROACH TO STUDYING THEATRE HISTORY AND DESIGN

‘The artist aims for an expansion of communication possibilities, to stimulate new relationships between people in the creative process and an interaction between people that creates meaning and thus a culture.’

(Popper, 1993, p. 180)

Based on theoretical and historical analysis, and case studies research outcomes (Chapter Three, Four and Five), this chapter promotes a new approach to theatre education and cultural heritage research, through employing 3D modelling techniques. Here, I attempt to prove the necessity of implementing new modes of knowledge visualization in a theatre studies classroom by analyzing some quantitative data collected through the analysis of the closed-questions questionnaire. It was designed specifically to elicit the responses of the students engaged in the first year undergraduate study at the School of Theatre, Performance and Cultural Policy Studies in the University of Warwick, in order to investigate their computer-literacy and whether they have a need for more technology-enhanced knowledge delivery.

At the heart of this chapter is my original practice-based contribution to the knowledgebase – the Set-SPECTRUM educational project. It aims not only to strengthen the established approach to research and teaching, but also to transform the passive consumers of yet another digital product into active participants. This project was created with the intention of giving theatre students and researchers a unique opportunity to understand and study one of the finest examples of unrealized modernist stage design – *The Divine Comedy* by Norman Bel Geddes – using digital means of presentation. In order to achieve the above goals, I



integrate the first fully-navigable 3D reconstruction of the original set within computer-generated educational settings, which are presented in a digital format as the e-Chapter. I attempt to develop a new and arguably better way to understand the essential elements of this unique piece of scenography, in ways which were not available for scholarly analysis previously.

This chapter presents the Set-SPECTRUM project's structure, rationale, intended outcomes, evaluation, limitations and future development.

## **6.1 The New Digital Reality in the Theatre Studies Classroom – the Questionnaire Analysis**

In the course of this study, it was concluded that new approaches to theatre education and research have been established through the global use of digital technologies of communication. There is little doubt that computer-mediated learning can greatly shift traditional modes of knowledge delivery towards a more visually-enhanced experience, which is especially important for teaching and researching scenographic artefacts. For example, 3D modelling and navigation techniques proved themselves very efficient in improving the understanding of communicative qualities of set design (e.g. form, line, color) and accelerating learning. There are, however, some reservations about whether such a highly technological approach will benefit the educational process as a whole. It could be observed that even now there is a considerable amount of doubt amongst contemporary teachers on students' computer literacy and their motivation for independent use of, for example, computer-based educational packages. On the other hand, there is a fear that computer-mediated learning could potentially shift students' attention away from concentrating on their studies towards a fascination



with technology. Furthermore, another line of argument against computer-based visual learning might be that digitally reconstructed artefacts do not provide a feeling of 'materiality', which is crucial for historical research and thus might confuse the learners. Indeed, some of these reservations are quite understandable; however, they can undoubtedly be addressed. For example 3D visualizations, if used together with analogue materials and explanatory textual information, can only enhance the quality of students' learning, as well as the teaching experience.

In order to identify what the learners expected from the study process, it was decided to develop a closed-questions multiple-choice questionnaire and distribute it among the first year undergraduate students in the School of Theatre, Performance and Cultural Policy Studies in October 2006 at their first introductory lecture. The decision to involve the first-year students only was made on the basis of using a target group, which could be described as naïve newcomers – i.e. it was critical for this study to question individuals, who were not yet aware of how the School runs, in order to explore their expectations of the course, as well as to analyze their study preferences and level of computer skills. The total number of participants constituted 47 (75% - Theatre Studies students and 25% - English students, undertaking some modules in Theatre Studies as a subsidiary part of their degree). Eleven items on the questionnaire measured the extent to which this target group is computer-literate, willing to use new media technologies in their studies, and interested in visual knowledge delivery. The collected data has been carefully analyzed and some of the research findings are discussed in the following sections, with the most significant of them presented in Figure 27. The complete questionnaire can be found in Appendix Nine of this thesis.



One unanticipated finding was that about 41% of the students were interested in scenography, visualization and digital technologies, and also in using new media in performance or, in other words, areas which constitute only a small part of the departmental teaching programme. Additionally, 85% and 98% of respondents expressed their interest in theatre and lighting design, stating that these fields would benefit to the highest degree from the greater use of visual technology. 98% indicated that it would give more flexibility to their studies, if they could access various software materials and electronic databases relevant to the course (e.g. the THEATRON online module); admitting that it would be visually more stimulating (93%) and also more fun (83%). The majority of those surveyed reported that access to such resources would be very practical (83%) and would help their learning (95%) because they would be able to be more reflective (93%) and do the work in their own time (98%).

When the subjects were asked ‘what type of electronic resources would you like to access during the class or while studying alone?’, 85% of the students mentioned visual materials on theatre design, with 41% expressing their interest specifically in 3D reconstruction of theatrical sets. 65% of the respondents found it important to be able to read biographical sketches of authors, directors, designers, and actors, and 76% expressed their interest in having a theatre glossary, which was an important finding to be considered for the future development of the Set-SPECTRUM educational project. The majority of participants (surprising 91%) were enthusiastic about independent learning; while only 40% expressed a strong interest in group-work.

The questionnaire analyses also indicated that 89% of the respondents were either computer-literate or have very good computer skills. Furthermore, in



response to the question about the greater use of ITC in the classroom, the questionnaire participants indicated that such an increase would lead to better learning outcomes (87%), make the course more interesting and engaging (80%), and also that more students would continue the course (82%) and be more likely get a job at the end of their studies (71%).

Another interesting discovery was that 81% of the students expressed their interest in participating actively in the knowledge delivery process (as opposed to passive consumption), while 53% would also like to have an opportunity to exercise their creative side.

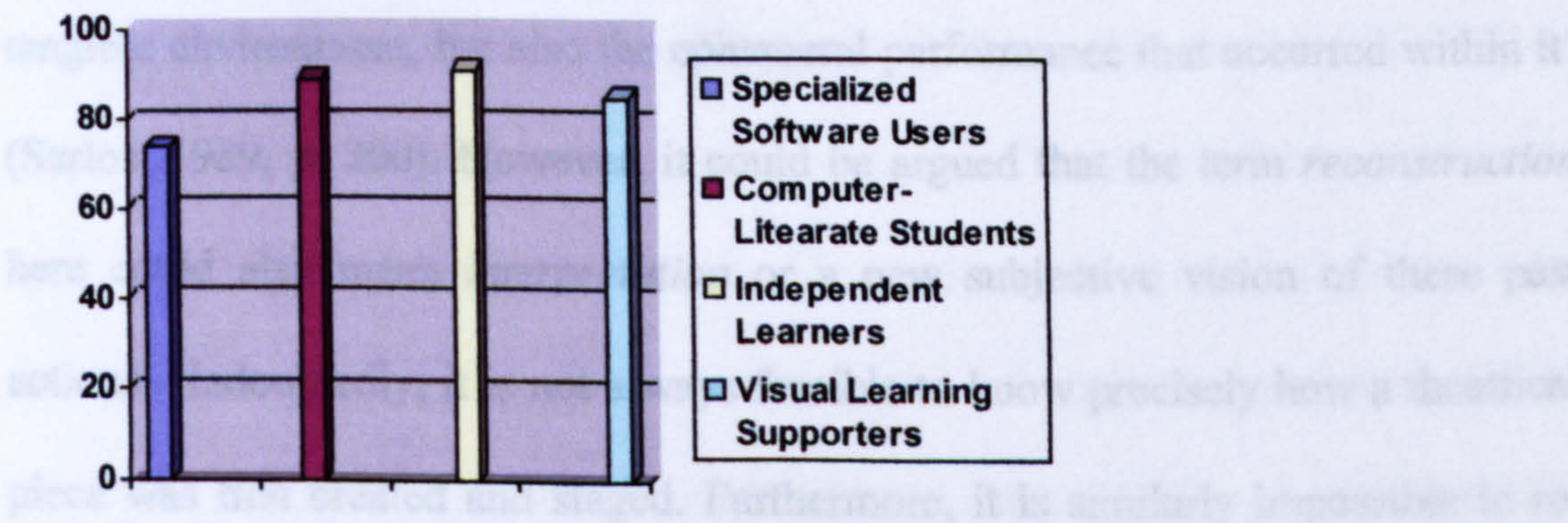


FIGURE 27: The close-questions questionnaire analysis. Author: Iryna Kuksa

This study reveals that even such small-scale analysis illustrates a clear need for a mutually beneficial reflective and visually-enhanced learning process for students studying the history of theatre and scenography, as well as for their teachers. Although there are some limitations of this quantitative investigation (e.g. all participating students were based in the University of Warwick), considering the results of the research undertaken in the course of the whole study, it can be concluded that the development and implementation of computer-based knowledge delivery platforms would be a helpful impetus for students to bring their familiar, media-influenced perception of life into the classroom. The



research outcomes also informed the design and development of the computer-based educational project – the Set-SPECTRUM presented as the practical component of this thesis.

## 6.2 The Set-SPECTRUM Project – Rationale

Performance reconstruction can be defined as the process of reviving various acting, performing, and even directing activities. Some scholars justify the need to re-create performances by calling it a lively approach to theatre research and arguing that, in order to ‘evoke various theatrical styles (of writing, design, and especially, acting and staging) one must attempt to reconstruct not only the tangible environment, but also the ephemeral performance that occurred within it’ (Sarlos, 1989, p. 200). However, it could be argued that the term *reconstruction* here could also mean *interpretation* or a new subjective vision of these past actions. Undoubtedly, it is not always feasible to know precisely how a theatrical piece was first created and staged. Furthermore, it is similarly impossible to re-create exactly the audience’s response to it, which was influenced by prevailing contemporary cultural, political, and societal values. Every performance is a creative process, which is influenced by the numerous factors determined by the time and place of staging, including the element of improvisation. This implies that no performance could be exactly the same every time it is staged or actually performed. Indeed, theatrical artefacts should be used to bridge the gap between past and present theatre practices; however, there is no need to go back to the beginning in a rigorous attempt to recreate the past actions, because, first of all, this is simply impossible and, as this study argues, also unnecessary. It should be noted that the recreation of scenographic artefacts differs from performance



reconstruction, in that the exact replica of the past set designs is often possible (if analogue materials are available) and sometimes crucial for scholarly analysis. In this case, the bridging between the past and the future is, although not entirely objective, but as close to the original as the performance reconstruction can never be. Indeed, it is feasible to use such reconstructed theatre settings for staging digital performances, originally planned for them through employing, for example, motion capture technology, which would probably be a breathtaking experiment carrying a significant research value.

### 6.2.1 Aims and Objectives

At the heart of this chapter and of the overall thesis lies the Set-SPECTRUM project. It was conceived by the author over more than a year-long period in the later stages of the study's evolution. The project was structured after all the necessary research had been undertaken and all crucial visual and textual materials had been discovered, evaluated, and analyzed. The Set-SPECTRUM promotes a new approach to theatre education and cultural heritage research through employing 3D modelling techniques as a flexible medium for effective and visually-enhanced knowledge delivery, attempting to give the users the most accurate and comprehensive visual and textual information on *The Divine Comedy* theatrical enterprise and its creator. The Set-SPECTRUM project aims to strengthen the existing approach to research and teaching, by transforming the learners into active participants with an opportunity to be engaged with the project interactively and creatively. Below, I will discuss its main objectives in an attempt to facilitate a full understanding of the research methods employed throughout the



dissertation, and provide a more transparent insight into the study's findings and conclusions, which are presented fully in the following chapter.

The Set-SPECTRUM project has been carefully designed to allow learners and researchers to access the unique visual materials for studying the history of theatre and scenography, as well as the essential elements of set design of this nature within particular settings. While the Set-SPECTRUM seeks to be comprehensive, it does not intend to be exhaustive or conclusive – presented in a flexible digital format, it is open for further development. The intention here is to enhance and extend the theatrical experience of *The Divine Comedy* set-concept and transform the ways to study it, without replacing the original visual resources. This project hopes to forge a middle ground between the present and the past of this extraordinary stage-construction.

The Set-SPECTRUM seeks to promote the wider goals of: (1) fostering scholars' awareness and appreciation of the integral connection between Norman Bel Geddes and his theatrical presentation for *The Divine Comedy*, and the evolution of the twentieth century American theatre; (2) creating new pedagogical models applicable to learning in the twenty first century, by promoting new ways of knowledge visualization in the mainstream curriculum; (3) making appropriate use of ICT, in order to raise the levels of students' achievements and contribute to the professional development of teachers through innovative methods of knowledge presentation and delivery; and (4) encouraging high quality self-assessment and enabling individuals to acquire lifelong learning skills and techniques.

This project aims to promote the combination of enhanced visual knowledge delivery and the opportunity to interact freely with visual and textual




materials presented in a consistent manner. The Set-SPECTRUM content has been developed specifically for educational activities in HE institutions, research centers, as well as the study units of theatre museums and galleries.


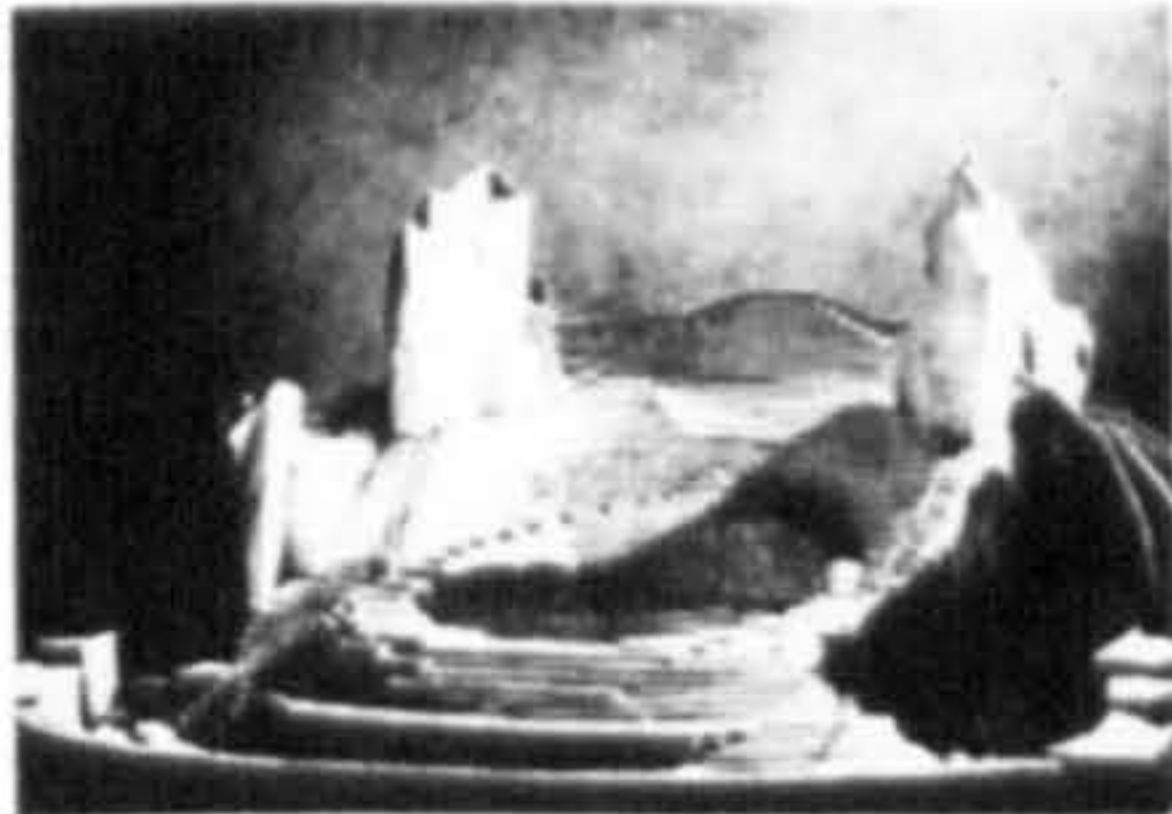
### 6.2.2 Structure

This subsection is presented in a form of the table (Table 9), outlining and explaining the main sections of the project's structure. This way of presenting the content of the Set-SPECTRUM was found the most efficient and easy for readers to perceive and understand.

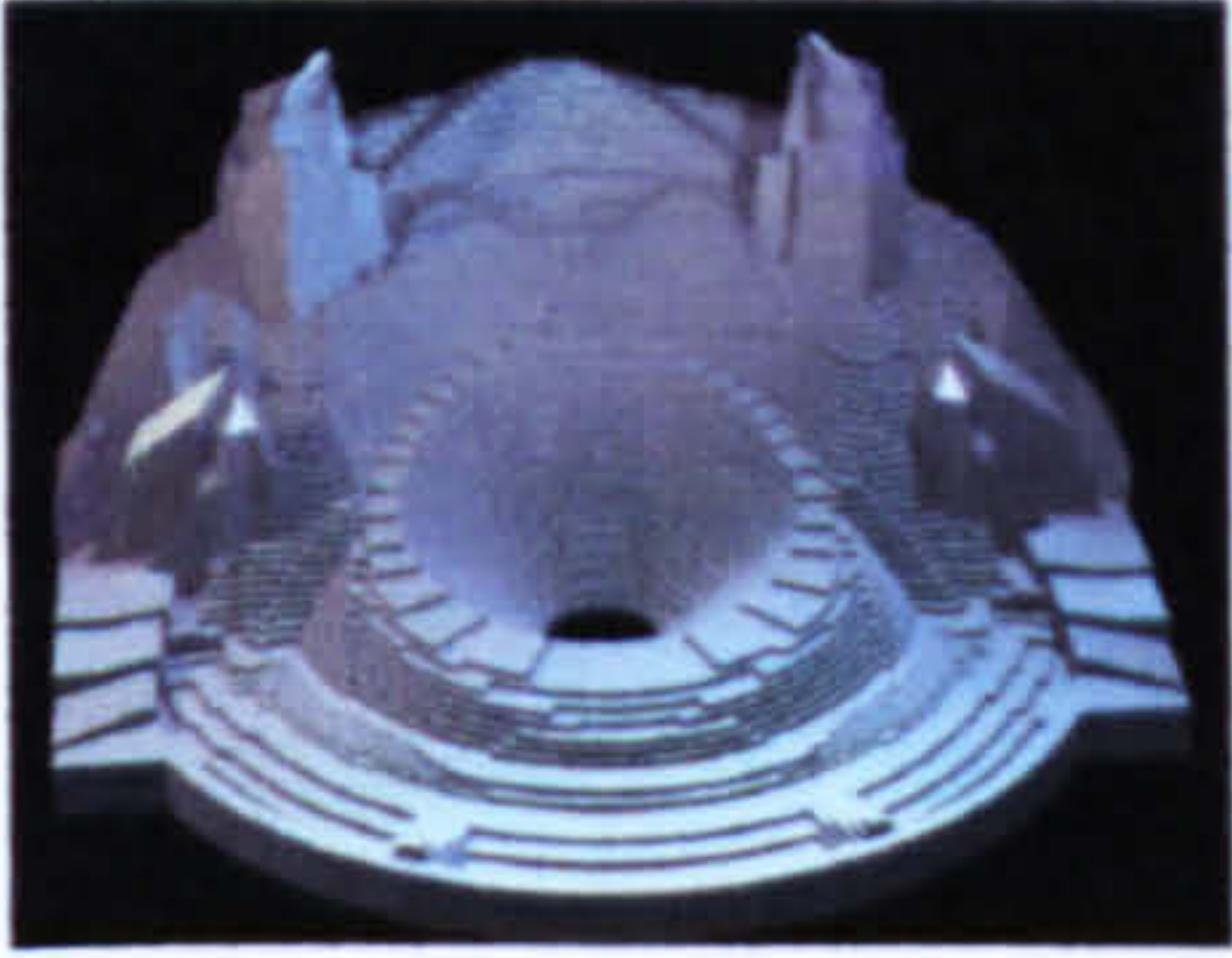
TABLE 9: Explanation of the Set-SPECTRUM Project Content. Author: Iryna Kuksa

Main Sections	Outline and Explanations
<p><i>Intro</i></p> 	<p>This creative piece of animation was designed specifically to visually introduce the Set-SPECTRUM project and its central component – <i>The Divine Comedy</i> set-model by Norman Bel Geddes.</p> <p>The video clip was made in Adobe Premier 6.5, where all necessary visual imagery was imported and saved in an appropriate format – i.e. JPEG, BMP and PSD for the pictures and scanned images and WAV for the sound files. The finished presentation was saved in AVI format, which is used specifically for video files.</p>
<p><i>About the Project</i></p>	<p>In this section, I, as the author of the Set-SPECTRUM, address the users, place the project within this practice-based study and explain briefly its aims and objectives. Here, I also acknowledge my collaborators (Eugeniya Kareva and Sergej Salnikov) and the research centre (the HRC), where all materials used for the project were found.</p>


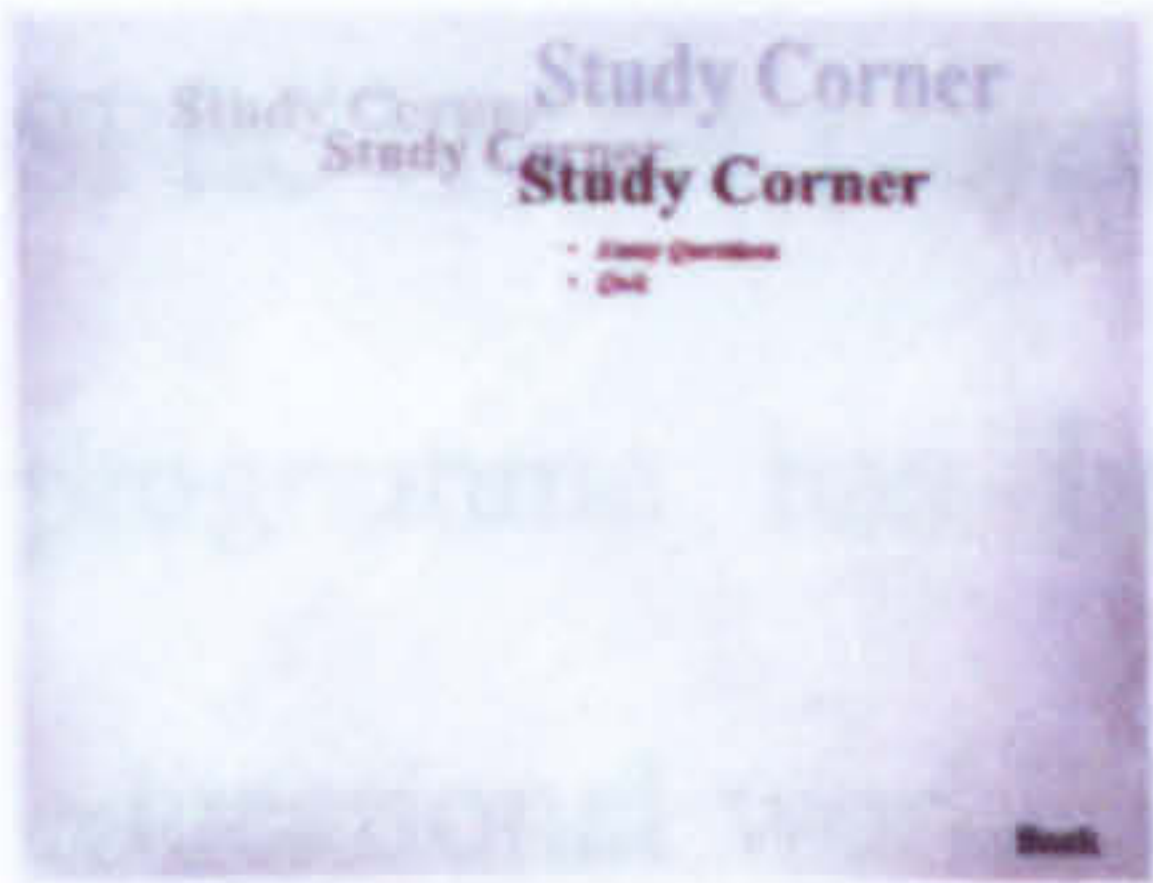


<p><i>Norman Bel Geddes</i></p>  <p>This section is based on the research presented in Chapter Four of this thesis.</p>	<p><i>Biographical Sketch:</i></p> <p>This section provides an insight into Norman Bel Geddes' biography and the progression of his creative career, revealing his personality and multiple talents. The biographical sketch presented here is an original text by the master himself.</p> <p><i>The New Stagecraft of the 20th Century:</i></p> <p>Here, I provide some background information on the early twentieth century New Stagecraft movement in Europe and North America, outlining its influence on the overall transformation of scenographic practices with the wider goal of placing Norman Bel Geddes within these historical settings.</p> <p><i>Philosophy of Designing for Theatre:</i></p> <p>In this part, I analyze Norman Bel Geddes' working approaches to design for theatre, and discuss the importance of his collaboration with Max Reinhardt.</p>
<p><i>The Divine Comedy</i></p>  <p>This section is based on the research presented in Chapter Five of this thesis.</p>	<p><i>Concept:</i></p> <p>This section analyzes the overall concept of <i>The Divine Comedy</i> enterprise, outlining Norman Bel Geddes' innovative ideas for this production and providing some background knowledge of how this exceptional example of modernist stage design was conceived.</p> <p><i>Set-Model:</i></p> <p>Here, I examine the original <i>The Divine Comedy</i> set-model, using Norman Bel Geddes' drawings and sketches, and Francis Bruguière's photographs, which provided a strong base for further analysis of its main aesthetical and technical characteristics, including stage construction, light, sound and costumes.</p>




	<p><i>Limitations:</i></p> <p>This section investigates possible reasons why <i>The Divine Comedy</i> project has never been staged and outlines possible implications, which the staging of <i>The Divine Comedy</i> might have had for the overall flow of the performance.</p> <p><i>Constructing New Reality:</i></p> <p>This part presents the first 3D computer-generated model of Norman Bel Geddes' original set design for Dante's <i>The Divine Comedy</i>. Here, I outline an illustrated process of 3D-reconstruction of the set-model, in order to assess its design-limitations and reveal some inconsistencies found during the digital modelling process.</p>
<p><i>3D Reconstruction</i></p> 	<p><i>Animation:</i></p> <p>The video clip presented in this section depicts the whole process of 3D digital reconstruction. The ability to slow down play-time (i.e. slow motion or step-frame facilities) and also re-play option, using Windows Media Player in a separate window, gives the project-users sophisticated tools to observe this dynamic process in intricate detail. The animation has been designed in a similar way to the Introduction video clip.</p> <p><i>Interaction:</i></p> <p>This section gives the viewers an opportunity to view the unique construction of <i>The Divine Comedy</i> set in 3D, but also to interact with it, using several navigation options. Direct 3D 9.0 Library was used to render 3D graphics for the digital stage-model, control the lighting, and navigate the cameras. The 3D programming for the set-model navigation has been conducted in IDE (Integrated Development Environment) Visual Studio 2005, using C Sharp object-oriented programming language. It was decided to employ a flexible text</p>



	<p>format XML (Extensible Markup Language) for creating and storing three sources of lighting, which users can employ creatively for illuminating the 3D stage-model from various viewpoints.</p> <p>In order to run the 3D navigation option, it is necessary to have Net.Framework V2.0 redistributable package installed.</p>
	<p><i>Navigation Help:</i></p> <p>This section contains all necessary information on how to navigate the 3D model and interact with the lighting using various window controls. It was realized in Microsoft PowerPoint 2003 and presented in an accessible and ‘easy-to-understand’ format.</p>
<p><i>Photo-Gallery</i></p> 	<p>This part allows the users to look at the 2D and 3D imagery in retrospective, following the process of creation of <i>The Divine Comedy</i> design from the early sketches to the computer-generated model. The original Norman Bel Geddes’ explanations of the plates (i.e. Francis Bruguière’s photographs) are also presented here.</p>
<p><i>Study Corner</i></p> 	<p><i>Discussion Questions:</i></p> <p>This section aims to boost creative thinking, research, and analysis activities, encouraging students to share their thoughts about the subject and empowering them to see themselves as active and necessary participants in their own learning. It is designed to facilitate peer discussions and promote conceptual development and consensual meaning-making in the domain of theatre design.</p>



	<p><i>Quiz:</i></p> <p>This part acts as a diagnostic instrument for assessing students' conceptual understanding and knowledge of the subject. Students make their predictions using a multiple-choice format with the correct answers given at the end.</p> <p><i>Bibliography:</i></p> <p>Here, I provide a list of all academic sources used in the project, which one would explore if the need for further information and research arose.</p>
<p><i>Contact</i></p>	<p>This section contains the contact information of the author of the Set-SPECTRUM project and her collaborators.</p>
<p><i>Structure</i></p> 	<p>This part outlines how the Set-SPECTRUM project is organized – i.e. illustrates all its sections and subsections for easy browsing.</p>

Microsoft PowerPoint 2003 was used for assembling and presenting the Set-SPECTRUM project as a coherent whole. For the last few years, this computer programme has become the dominant presentation tool, especially in the educational world. It can demonstrate complex computer graphics and animation stored in a wide range of formats, which can be shown in the large auditoriums and, if necessary, can be easily exported to the Web or Intranet for viewing, publishing, or being printed as handouts. This flexible, widely available, straightforward, and interactive software supports the diversity of visual outcomes of this research and provides easily accessible, editable, and secure data storage. It is expected that many potential users of the Set-SPECTRUM project would



already be familiar with Microsoft PowerPoint or they would be able to learn and start using the project's materials reasonably fast. The Set-SPECTRUM project's Instruction for Use and System Requirements are provided in Appendix Eleven of this thesis.

### **6.2.3 The Set-SPECTRUM Project's Pilot Testing and Evaluation**

In order to assess the accessibility and overall effectiveness of the Set-SPECTRUM in visually-enhanced knowledge delivery, the anonymous survey (Appendix Ten) was developed specifically for the project's evaluation exercise, which was undertaken in the University of Warwick by the MA International Design and Communication students on November 29, 2006. This pilot testing was performed under the Visual Analysis and Interpretation module as a Design Evaluation practical exercise, which is an important part of this MA's curriculum. Students totaled fifteen and were divided into three groups of five people, for assessing the project.

Although there were certain limitations to this research activity – e.g. the small number of the participants and their affiliation with the Set-SPECTRUM project's author as a module leader, the results of the evaluation were very reassuring. All students agreed upon the clarity and informativity of the project's content and the consistency of its format. Only one respondent was undecided about the ease of interacting with the project's resources and navigation through its content, while the rest confirmed that it was fairly straightforward. The majority of participants (87%) reported that it was simple to navigate the 3D set-model, especially after reading the Help section's explanations. Fourteen students (one was undecided) found the Set-SPECTRUM project's visual presentation



techniques crucial for the understanding of the essential elements of *The Divine Comedy* set design. A further, to a certain extent unexpected, result of this survey was that one third of the students were undecided about whether the Quiz section is a necessary part of this project. They generally agreed upon the usefulness of the Discussion Questions section, but found the Quiz part rather tedious. At the end, however, all participants expressed strong interest in using similar innovative computer-based products for educational purposes.

Even though the Comments section of the survey was optional, ten out of fifteen students took the initiative to write very positive feedback on the project, making a number of interesting suggestions for its future development. Some of the comments were as follows: ‘Very interesting and visually appealing. Displays the fact that a lot of research has gone into it. The 3D model is a work of art and brings an aspect of fun into the project.’ ‘Very visually impressive and interactive. Catches your attention and helps you to understand all stages of this particular set-design.’ ‘It is nice to profoundly discover the thing which has been forgotten before.’ ‘Clear content.’ The suggestions include the following statements: ‘The test part [Quiz] is a little bit boring, especially compared with the 3D presentation.’ ‘Maybe some ‘Next’ buttons could be added beside the ‘Back’ buttons.’

The results of this survey indicated the genuine interest of the students in the new modes of learning introduced by the Set-SPECTRUM project. Certainly, it is unreasonable to assume that the above data are representative, because a *convenience sampling* method (Gillham, 2000, p. 18) was used for the expediency of this research, in order to acquire a gross estimate of the results. It should be noted, however, that such an approach is widely applied by many researchers to



collect valuable information especially in a pilot study, therefore, it was found very useful and even necessary for this particular case.

#### 6.2.4 Limitations and Future Development

As the practical component of this PhD study, the Set-SPECTRUM project fulfilled all the outcomes intended for this stage of research. Furthermore, it opened new lines of investigation and a variety of exciting opportunities for future development. It should be noted, however, that this is a work in progress, which will go beyond this Doctoral thesis; therefore some limitations of the project were unavoidable. The Set-SPECTRUM was conceived and designed solely by the author, who also paid all the implementation costs. Available professional assistance with the 3D reconstruction (Eugeniya Kareva) and programming (Sergej Salnikov), enabled the realization of the most important stages of the project's development – i.e. the scrupulous 3D reconstruction of *The Divine Comedy* set-model, 3D programming, the structure and layout design, and also the development of the educational component. There are, however, still some unrealized ideas, which could be considered to be limitations at the present stage of the Set-SPECTRUM project's development, but also could be seen as the future lines of research.

For example, the Set-SPECTRUM project's users are already given an opportunity to interact creatively with the computer-generated 3D model by illuminating it, using various light sources and filters from the different viewpoints. For the future, it is also planned to allow them to dismantle various parts of the set and to assemble them back together (the so-called Set Puzzle section), which would be very useful for learners, in order to explore and



understand precisely the external and internal construction of this complex stage-model. Furthermore, another aspect of the Set-Puzzle module would enable users, not only to interact with the original structure of the set-model, but also to create new designs by using available scenic parts. For this purpose, a simple piece of software suitable for 3D manipulation will be incorporated within the body of the project, as another line of its future development.

In order to further strengthen the proclaimed accuracy of the computer reconstruction of *The Divine Comedy* set, it is intended to produce a series of overlays of the 3D model with Francis Bruguière's photographs of the production. In addition, the Set-SPECTRUM team, if the appropriate funding is obtained, will attempt to recreate digitally the most thoroughly-designed act of *The Divine Comedy* – the *Inferno*, using available primary sources. Furthermore, there is a plan for developing a reference point – i.e. a human figure – for the users to understand clearly the intended proportions of the real stage. Such development would also be necessary for the introduction of the characters involved in the performance – i.e. actors, wearing costumes and masks designed by Norman Bel Geddes. This is important, in order to visualize fully the *Inferno* as the author had planned it, especially because the actors in this production were supposed to be one of the crucial parts of the scenic design. For this reason, the implementation of user-manipulable avatar technology could be considered. In order to achieve all the aforementioned, however, there is a need to undertake further research at the HRC in the University of Texas in Austin.

### 6.3 Concluding Remarks

The Set-SPECTRUM project attempted to develop a novel conceptual model to support the study and research of 'lost' scenographic artefacts through employing



innovative technological means of knowledge reconstruction, presentation, and delivery. The effort was made to develop materials and activities specifically to arouse the aspirations of potential users to learn about Norman Bel Geddes and his visionary set design for Dante's *The Divine Comedy*. The Set-SPECTRUM proposed an effectively engaging approach to designing educational software, which was developed through longitudinal, cross-disciplinary research, aiming to provide a long-term pedagogical impact and satisfaction for potential user-groups. It is a novel product. Its goal is to enable the development of the users' visual and technical literacy and research skills. The Set-SPECTRUM aimed to employ a new and useful vocabulary for learner-artefact interaction and creativity-training, providing greater knowledge of the use of new media technologies within the classroom and the potential to explore difficult and sensitive subjects.

Furthermore, this project has been designed to bridge research and creativity in a communicable and systematic manner, in order to allow the identification of the next stages of promoting visually-enhanced learning. The Set-SPECTRUM is envisioned ultimately as a source of knowledge, but also as a catalyst for creating new educational and design applications and customizing the teaching curriculum in the field of theatre studies.



## **CHAPTER SEVEN: DISCUSSION AND CONCLUSIONS**

Artists are free to apply their imagination to aesthetic problems, even while conforming to certain constraints arising from the techniques or technologies used. They are able to employ a diversity of means, always remaining open to new experiences. Their freedom of imagination, however, imposes on them the rigour of an exceptional lucidity and moral responsibility. In fact, the artist must grasp the applications of his or her research in daily life even more than the scientist who has historically often discovered their implications much later.

Popper (1993, p. 161)

The purpose of the present study was to investigate multimedia as a technological, cultural, and educational medium, as well as a creative platform in its own right. In order to achieve this, it was necessary to undertake both theoretical and practical research. Primarily coming from a scenographic standpoint, this thesis explored various factors that support or suppress the development and implementation of multimedia applications for learning purposes, and creative development in the field of theatre studies and cultural heritage research. The research for this thesis was motivated by recent debates on media evolution and the ways it influences various fields of knowledge. A number of issues surfaced from these discussions and were investigated by me within theoretical, historical, educational, and practical settings. Consequently, several gaps in the body of literature and ongoing research were identified, by analyzing primary and secondary sources, which required combining a multidisciplinary synthesis and broad historical analysis. Additionally, a critical overview of literature and ongoing research projects relevant to this study was undertaken, with particular focus on investigating a number of trends, strategies, socio-cultural and educational aspirations of a new digital reality. Through the present study, I wished to promote a sound understanding of the key concepts necessary for



interpreting multimedia applications within the field of theatre studies, concentrating on the theory and practice of theatre design and education.

In this chapter, I provide a short summary of my work, discuss the main findings, and identify some directions for future research. This chapter consists of two major parts: Discussion and Conclusions. In the first part, I will summarize briefly the research undertaken for this dissertation by: (1) investigating the primary elements of contemporary media and exploring their roots in performance arts before and during the digital epoch; (2) exploring new technology-oriented teaching techniques that attempt to develop a new media platform in theatre education; and (3) discussing IT applications that transform the way we experience, learn and co-create our cultural heritage.

In the following section of Conclusions, I will: (1) discuss the significance and outline the main findings of this practice-based dissertation; (2) summarize the contributions of the study to the knowledge base, by re-stating the main research questions and justifying the interpretive methodology used to explore them; finally, (3) I will discuss the limitations of this study, making some suggestions of what could be done, in order to facilitate better access to technology-enhanced educational resources and suggest future lines of research.

## **7.1 Summary and Discussion**

Throughout the period of this study, the development of computer-mediated forms of communication, manipulation, production, storage, and distribution underwent significant transformations. During the first couple of years of my research the main tendency in their development was to achieve the best possible transparency within the medium (e.g. computer interface) to immerse users naturally in



computer-generated environments. These attempts were and still are directed mostly towards creating a special atmosphere, where the user can concentrate fully on a given task without being distracted by the frame of a material interface. A good example here is the use of VR applications for pilot or surgical training. Unfortunately, it generally proved impossible to adapt these immersive techniques for work in the field of arts and humanities, mostly due to the prohibitive costs of equipment, and the lack of the necessary technological expertise, which causes low motivation amongst potential, in addition to actual, users.

At the beginning of the millennium, the majority of IT scientists were convinced that the next generation of computers would be embodied (i.e. personified) appliances (e.g. Abowd and Mynatt 2000; Cheok *et al.* 2002). Indeed, the most recent developments in mobile digital technologies illustrate a clear shift towards numerous display and screen devices of different sizes, leading towards ‘framed’ observation of contemporary digital reality. However, there is a tendency within academic circles to advocate that this highly-technological, but ‘framed’ approach to creating performance space is not desirable. Critics believe that because members of the audience are unable to abstract themselves from the numerous surrounding frames, the very nature of theatrical experience is jeopardized. This study, however, suggests that it is highly unlikely that future generations of technology users – who have been surrounded by various screen technologies from early childhood – would even perceive a delivery medium between them and a virtual object or a performance, as a frame. It could also be argued that they would apply automatically traditional *willing suspension of disbelief*, while perceiving any digitally supported cultural artefact or performance.



As mentioned in the literature review, the ongoing digital revolution we are currently experiencing could be classified as more profound than previous media transformations (Botler and Grusin 1999; Manovich 2001; Grau 2003) mainly because it affects all existing types of media simultaneously creating new ones. It is worth noting, however, that the twentieth century modernity-post-modernity paradigm shift marks a major breakthrough in various fields of knowledge, including performance arts (Kershaw 1999; Baugh 2005). Nevertheless, this study argues that new media technologies do not simply enhance existing cultural practices and traditional scholarship, but also challenge their very nature, encouraging new ways of interaction and knowledge delivery (refer to Chapters One and Two for a full discussion). It may be the case therefore, that such a challenge has a double-sided impact on contemporary creative practitioners, who might go from one extreme of concentrating only on technology and its capability to enhance the quality of presentation, to another – a complete ignorance of technological innovations, because of their potentially damaging effects on artistic creativity (Carson 1999). There is little doubt that the cyber-world can enhance creativity without losing the main idea of any art or live art project behind technical specifications; however, this study attempted to illustrate that technology can also be creative.

This study is in agreement with Botler and Grusin's (1999) finding that the act of *remediation* has been responsible for re-constructing our culture for many decades, if not centuries. Any new technological transformation of human society has had a series of side-effects. The present digital era is not an exception. Invasion of privacy, abuse of intellectual property, digital vandalism, and data theft are just some of the problems technology creators and consumers have to



solve, and, unfortunately, not all of them can be addressed yet. The integration of computation technologies into almost every aspect of our everyday lives has also led to the blurring of traditional boundaries between disciplines and discrete media. Certainly, this process has not just begun. The evolution from the *total* (Wagner 1849) to the *open artwork* (Eco 1962), for example, did not come as a surprise. Media and also multimedia are constantly evolving phenomena, and the artefact once translated into digital format can achieve some sort of ‘immortality’ through the vast possibilities of how it can be studied and even modified.

The present study found that in order to understand the full impact that multimedia has on our cultural heritage, it is necessary to be familiar with its primary elements. One of them is the international and transnational phenomenon of interactivity (Popper 1993; Negroponte 1995; Willemsen, 2002; Steiner and Tomkins 2004), which enables reciprocal exchange between viewers and artefacts, and encourages the intuitive manipulation of the medium. Others are hypermedia and narrativity (Packer and Jordan 2001), which caused the collapse of traditional spatial and temporal boundaries and diminished the conventional domination of a narrator, by linking various information and media in non-linear or non-sequential ways. There is little doubt that these media elements enabled new types of social relationships and knowledge delivery in contemporary society. Theatre studies here are not an exception. This field was also influenced strongly by rapidly developing innovative means of communication. Traditionally, it combines different media elements and supports the constant connection between the audience and the stage. There are some prior studies (e.g. Causey, 1999; Reaney 2000; Wunderer, 2002) that have noted that theatre art and VR resemble each other, in that they both create a fictive 3D universe for



entertaining and engaging with the viewers. The findings of the current research are consistent with the aforementioned and also suggest that virtual reality should be treated as a performance platform in its own right, encouraging the development of intrinsically different theatrical events. It should be borne in mind, however, that computer-generated environments and virtual characters, which are created intentionally for theatre performances, could also be interpreted as artificial animation on-stage (Carson, 1999).

Importantly, my analyses demonstrate that there is a lack of research into how new media technologies could influence the appearance of new forms of theatre. This study has found that the rapid development of computation technologies makes it often difficult, and sometimes impossible, for artists to choose the appropriate technology to coincide with their visions, especially if they lack the necessary training. Here the issue of education arises. The results of my investigation show that there is a shortage of educational projects, which focus particularly on computer-based information exchange and creative development. Since the late 1990s, researchers (e.g. Jonassen and Reeves 1996; Valdez *et al.* 2000) noticed that e-learning amplifies, extends, and enhances learners' cognition, and helps students to store, reshape, and analyze information. However, there were, and still are, concerns about the overall capacity of these initiatives to take root and change the established approach to education – specifically while studying scenographic artefacts. Despite this, technological innovations have already encouraged some reforms in the educational sector, including new developments for students' learning and also teachers' professional growth. This is happening, partly, to promote the visual element of learning (Beardon and Enright, 1999; Denard, 2004), which is an integral part of theatre education and,



unfortunately, often missing from existing teaching practices; and, furthermore, to support multiple learning styles, encourage self-centred learning and the personalization of knowledge delivery.

Certainly, e-learning is a relatively novel technique, and there is no doubt that any e-course or project should be structured with care, focusing the students' attention on the study contents, rather than the technology that communicates it. At the present stage of technological awareness in the field of arts and humanities, there is a growing need to blend carefully innovative applications – such as telepresence, 3D modeling and navigation – with traditional teaching techniques, in order to avoid the potential risk of social exclusion (refer to Chapter Three for a full discussion) and thus low motivation. In the area of theatre studies, for example, a major aim is to develop the visual skills of the students that enable them to use imagery as a creative tool and also as a means to analyze theatrical performances (Beardon and Enright, 1999; Baugh 2005). The present research found that this could be done most successfully by employing computer-based teaching, including 3D visualization methods, with simultaneous support of other learning activities. Indeed, the computer-generated environments are a logical extension of arts integration and, furthermore, as some researchers argue, an ideal place for applying existing knowledge (Packer and Jordan, 2001; Giannachi, 2004). Therefore, the development of software packages and educational projects for various disciplines within theatre studies, but particularly for teaching history and principles of scenography, would benefit greatly the very nature of scholarship.

I analyzed in detail two recent VR projects (case studies, Chapter Three) and found that both suffered from a severe shortage of funding. These projects



suggested how to make certain categories of data and evidence more accessible (the THEATRON project) and how to explore the boundaries of manipulating two-dimensional images within three-dimensional space (the VA project). They also proposed easily accessible delivery platforms, but have not received sufficient financial support to develop their full impact and achieve all of the objectives. One of the most significant findings to emerge from this study is that, in order for a computer-based educational project to be successful, it is necessary to combine both visually sophisticated learning materials and an opportunity to interact with them in a creative way. There is a need for learners to be transformed from being simply passive consumers of another digital product to actual participants with the opportunity to experiment, communicate their ideas, and examine their knowledge. Thus, the main goal of the practical component of this thesis was to create a *combined* digital package that equally contributes to educational and creative practices, and also fills a gap in the history of the Western theatre design. The case study of the THEATRON online module provided some basic ideas for my project – the Set-SPECTRUM. This study has found that generally the THEATRON was effective in changing the awareness of new ways to present information, in order to educate theatre and archaeology students. However, many of the suggested innovations for teaching style, unfortunately, remained ideas only, and those that were implemented, did not receive as much acknowledgment as they deserved. The Set-SPECTRUM further developed digital reconstruction techniques linking them to a hyper-textual mode, and, furthermore, introduced some interaction and co-creation opportunities for its users to be artistically engaged with the project's materials. The goal here was to



emphasize the potential value of a synthesized visual approach to teaching and researching scenographic artefacts.

The Set-SPECTRUM was designed to overcome some limitations of the earlier projects and produced the first 3D digital reconstruction of the set for Dante's *The Divine Comedy* by Norman Bel Geddes. Here, I supplemented this digital artefact with relevant historical information and illustrations of the modelling process, as well as with various tools for educational and research purposes (e.g. navigation, animation, creative engagement, and knowledge testing options). The present study argues that the 3D model could be qualified as a contribution to the knowledgebase in the field of theatre design history. This computer reconstruction was necessary to visualize the unity of the original concept and combine it with the 'wow' factor Bel Geddes wished to create for his production. Finally, it was crucial, in order to drastically improve the ways in which the academic community perceives and values Bel Geddes' visionary ideas.

Computer-based information space provides an opportunity to explore how new forms of knowledge delivery can be applied and how digitally reconstructed artefacts can be experienced in an integrated way. One might ask, however, why it is necessary to employ new means of teaching, if the old ones are still working? The answer is simple – because the tendency is that new generations of learners see the HE institution as a place with crucial resources, tools, and knowledge for research, innovation, and individualized and even lifelong learning. These demands lead to a shift towards technology-based education, which is different from technology-assisted learning in that it is not always able to provide global orientation with resources and communities. In the area of theatre history and design, the availability of visual information is



particularly relevant to support the study process. Thus, when translated into digital language, scenographic artefacts become easily retrievable and highly accessible for learning and research purposes. There is little doubt that in the future, visual resources will grow in importance as primary source materials. The Set-SPECTRUM project serves to bring this information to the learners and the key-innovations it offers, deserve to be shared as widely as possible. Changing awareness means changing standards for what is acceptable – and this happens best when people are repeatedly exposed to new ideas. This thesis argues that there is not just one way to change awareness of new teaching techniques and their potential benefits. Such digital products should be productively promoted, not only through realization but also training because the need for communication and presenting new knowledge is critical.

## **7.2 Conclusions**

Multimedia is one of the most widely-studied topics in the various fields of academia. Nevertheless, much research remains to be done, due to the evolving and ubiquitous nature of this phenomenon. Although taken as a whole, the available information enables a qualitative assessment of the history of new media and their influences on different fields of knowledge, there are still some areas left relatively unexplored mostly as a consequence of their cross-disciplinary qualities. For example, in theatre studies, the majority of research on multimedia is undertaken in connection with experimental performative and scenographic practices (e.g. LeNoir, 1999; Reaney, 2000, 2000a; White, 2006) and historical analysis of theatre evolution in the context of the digital realm (e.g. Giannachi, 2004; Baugh, 2005). There is also some interesting work being done on the



assessment of new media influences on the evolution of theatre design and designers (e.g. Beacham, 1994; Carson, 1999; Carver and White, 2003; Aronson, 2005; Baugh, 2005) and the learning atmosphere in a theatre studies classroom (e.g. Denard, 2004; Williford, 2004; Beacham, 2006).

Consistent with the findings from the aforementioned and other media (e.g. Botler and Grusin, 1999; Manovich, 2001; Rieser and Zapp, 2002; Grau, 2003), social studies (e.g. Valdez *et al.*, 2000; Sheth, 2003) and practice-oriented (e.g. Beardon 1999 and 2001; Eversmann, 2001; Denard, 2004; Beacham 2005 and 2006) researchers, this study identified the visualization of knowledge using new media technologies as a principal factor for advancing theatre education and research practices and overall development. As no previous work, addressing the problem of employing the technologies of computation as a tool for the reconstruction of ‘lost’ scenographic artefacts and simultaneously as a knowledge delivery and research platform appears to exist, this dissertation concentrated on this niche, exploring various issues surrounding three main foci (Fig. 28): (1) media evolution and the history of scenography, (2) technology-mediated learning and e-learning; (3) novel computer visualization techniques.

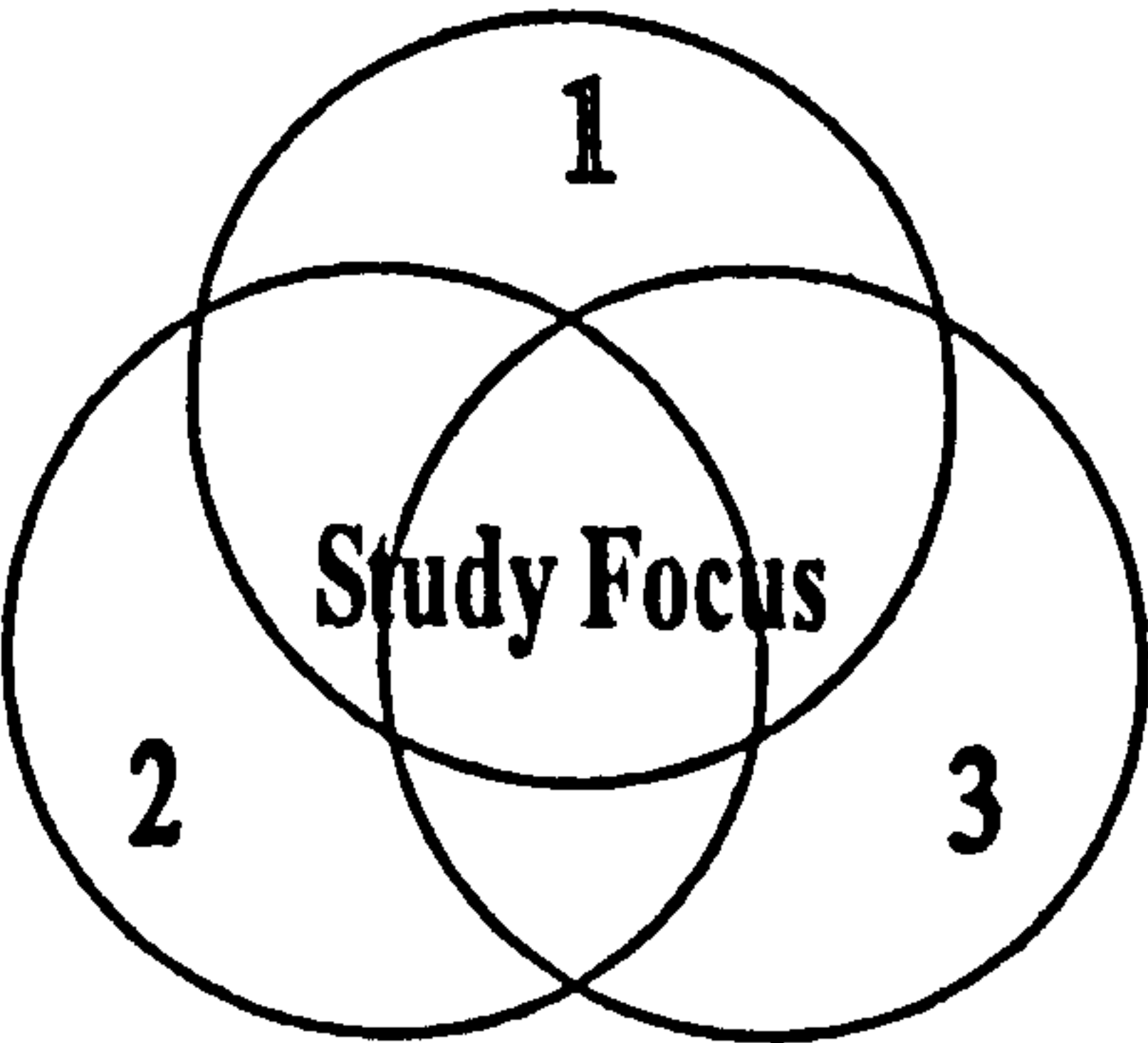


FIGURE 28: Focus of the Study. Author: Iryna Kuksa



### **7.2.1 Research Findings**

This study employed a novel practice-based approach in a rigorous attempt to address three main research questions, which led this multidisciplinary work:

**Research Question 1** (for a full discussion, see Chapter One and Two): To what extent does the marriage between art and technology influence the ways in which theatrical space is created, perceived, and researched?

A multidisciplinary literature review revealed the need for more academic research into the relationships between technology, scenography and performing arts. This thesis has attempted to throw light on the role of new media and computation technologies in the evolution of theatrical space, where set design is often an essential component. My findings suggest that nowadays computer technology is already seen as an integral part of almost every theatre venue, but relatively novel techniques such as VR and live performance webcasting are often perceived as a threat to artistic creativity, because they may alter the very basis of traditional theatre-making, meaning that they have the potential not only to enhance, but also to transform the ways in which we design and perceive theatre space. Although current experimental productions are critically important for defining tendencies in the future development of contemporary theatre, this study concludes that, in order to overcome prejudices, there is a strong need for dedicated funding, and special technology-mediated training of future theatre scholars and designers.



**Research Question 2** (see Chapter Three): To what extent do new media communication and interaction platforms transform knowledge delivery and develop creativity in the theatre studies classroom?

My research attempted not only to look at the advantages and disadvantages of computer-mediated knowledge delivery (Chapter Three), but also offered a constructive solution of how it can be married with creative techniques (Chapter Six, the e-Chapter). The methods chosen here are rooted in a coherent theoretical framework that enabled the investigation of the true potential of a few existing computer-based educational projects. By applying a case-study approach, this thesis revealed that there is a strong need for visually-enhanced technology-mediated knowledge delivery, especially for studying scenographic artefacts. Considering the latest shift towards personalized learning, this research concluded that it is necessary to create *combined* computer-based educational packages that contribute equally to theory and practical work in the field of theatre studies. These digital products have the potential to give their users an opportunity to create, experiment, and communicate their ideas. This study's findings add to the body of literature endorsing the collaborative use of appropriate computer-mediated products, and suggesting that *combined* computer-based educational projects should be seriously considered by future developers of the educational digital products in the field of theatre studies.

**Research Question 3** (see Chapters Four, Five and Six): How can 'lost' artefacts be studied effectively?



Related literature and a case study approach informed the creation of the Set-SPECTRUM project (Chapter Six and the e-Chapter), some aspects of which were influenced by alternative conceptions in the area of computer-mediated learning and creative practices. The project development was guided by the research conducted for this thesis in Chapters Three, Four and Five. The Set-SPECTRUM offers a multi-dimensional and dynamic approach to studying and researching 'lost' scenographic artefacts, by digitally reconstructing them as navigable 3D models. The project is focused on a consistent theoretically and practically founded pedagogical baseline, as well as the utilization of object-oriented, 3D modelling techniques.

Another contribution of this study is that it has called attention to the American stage designer Norman Bel Geddes, whose visionary, but largely overlooked (or underestimated) set concept for Dante's *The Divine Comedy* served as an example for the practice-based part of this thesis. I argue that this piece by Bel Geddes had lasting impact on the evolution of the performance space in the USA (and possibly Europe) in ways which are stronger than had been previously anticipated.

### **7.2.2 Analyses of Findings and Future Dimensions of Research**

The importance of evaluating critically the results and significance of the whole study is obvious. There is also little doubt that every research project has certain limitations that need to be taken into account. Some of these limitations, however, can be seen as fruitful avenues for future investigations under the same theme. Even though the current state of research presented in this thesis provided substantial support in understanding new media technologies, their influence on



various disciplines, as well as on practical applications for studying and researching scenographic artefacts, in retrospect there are some aspects that have yet to be considered.

### *Theoretical Limitations and Perspectives: Multidisciplinary Approach*

The first limitation concerns the cross-disciplinary nature of this practice-based research project. Criticism can be presented in relation to the way the theoretical overview (Chapters One and Two) is applied in this work, because its base may be described as being fragmented, as it includes a variety of viewpoints on the subject. However, the purpose of adopting this kind of strategy has been seen by the author as strength of the present thesis. It was my conclusion that since there was interesting research across the different theoretical perspectives, it was worthwhile applying at least some of them in this study. It could be argued that this interdisciplinary approach was beneficial for the quality of the thesis; since it attempted to bridge various views in a novel way, creating a strong base for future investigation, by raising some interesting questions that could serve as starting points for the upcoming research.

It would be fair to say that nowadays our aesthetical and ethical choices are tangled in the digital realm. This raises the question of how cultural identities are being transformed in the digital age, in which we are living. The lines of investigation here are numerous – from addressing the ethical and legal issues of virtual communities, existing solely in the digital domain (Creed, 2000); to exploring the aesthetic consequences of employing the computer as an active contributor of the creative process (Youngblood, 1970) or even re-defining what the aesthetics of the virtual world is. Some researchers argue that VR applications



already affect the classical theatre negatively, but does that mean we should actively refrain from using these technologies? It is difficult to control the work of art placed in virtual space – from how it was created to how it will or should be perceived by the audience. The term *original* is foreign to a computer, thus the question here is how to define various artefacts, performances, and characters once they are translated in digital language? It is a fact that the human perception of the difference between artificially constructed space and reality can be temporarily overwhelmed by using various images – i.e. ‘as if’ effect (Grau, 2003, p. 17). Therefore, theatre performance could be seen as relevant to electronic and digital media phenomenon, because it encompasses such important questions as interaction, response, feedback, and the relationship with the audience (Gere, 2002, p. 84). However, it is fair to ask which new possibilities the digital era offers to theatre language. Certainly, theatre is an ephemeral art, which happens in its time and of its time and it could be argued that trying to catch it in VR is anti-theatrical. Possibly, the whole VR movement in theatrical space is just a reflection of human culture, which keeps evolving, and sometimes enters a non-adaptive dead-end? Or maybe we are trying to adopt these technologies because they are there – not because they are suited for application in theatre. Nevertheless, there is certainly no need to fit all these innovative techniques within conventional theatrical settings – perhaps this is the time to create a new form of theatre.

There is no doubt that every medium and media event is integrated within social and economic environments (Botler and Grusin, 1999) and cannot exist or work in isolation. However, the question here is how copyright conventions will be changed in the context of the digital realm, in order to regulate virtual culture? Furthermore, should the technological development and its implementation in art



and theatre be guided? Or, on the contrary, should they be free of any kind of censorship and external guidance? It is obvious that such issues will require a long time before they settle down; however, it could be said already that the development of our culture, society, art, and theatre is and certainly will be, closely linked to the evolution of surveillance space. This development extends from, for example, introducing absent actors through using video monitors to the rest of the troupe, to integrating surveillance-like moments into theatre performances (McGrath 2004). Some researchers (e.g. Gere, 2002, p. 202) already fear that ‘soon no aspect of our lives will remain untouched by these ubiquitous invisible forces’, which certainly poses the question: if too much control is enforced would the creativity suffer? These and many other questions need to be addressed by future researchers.

### *Educational Limitations and Perspectives: Practical Approach*

This study showed that there is a need for further exploration and justification of overall computer-based educational practices. Generally, it seems there is a fast-growing interest in visual knowledge transfer, including 3D modelling techniques, as more research papers and projects in this area are emerging. Nevertheless, better strategies are needed to improve the quality and comprehensiveness of digital study-resources and, in particular, to encourage their sharing. For example, the necessity of implementing novel means of delivery of various visually-driven subjects (e.g. history of scenic design) deserves researchers’ attention. As learners become more computer-literate and familiar with e-learning techniques, there is a possibility that adhering to the old methods of knowledge transfer may not only cause low motivation in meaningful engagement with the study-subjects, but also



negatively affect their overall perception of digital media, as representations of reality. However, such issues as the credibility and authenticity of computer-generated materials – reconstructions and simulations – must also be addressed.

To what extent can my findings be generalized beyond the case studies presented in Chapter Three? One might argue that their number is too limited for broad generalizations. However, the two projects evaluated in this thesis represent different aspects of the software development processes, which were relevant to this research and necessary for the Set-SPECTRUM project's design. Theatre is the art of entertainment, so why should we not make the study of it amusing too? This thesis attempted to address the increasing demand for better quality visual educational resources, by presenting a theoretical study of Norman Bel Geddes' creative career, working methods and theatre designs (Chapter Four and Five) using novel, interactive modes of representation (Chapter Six and the e-Chapter). There is little doubt that some findings related to this subject warrant further investigation, in order to integrate Bel Geddes' contribution to the development of modern American theatre and stage design more firmly within historical and also educational settings. Furthermore, additional empirical evaluations are needed to replicate the findings and further test the overall effectiveness of the Set-SPECTRUM in different contexts. The constraints of this study restricted the full investigation of the learning outcomes associated with the project testing and evaluation. The specific design of the Set-SPECTRUM could also be further researched and developed in the future. Some of these issues represent further extensions of this study's findings, while others are new, but important issues waiting to be explored. The educational approach presented in this dissertation requires the dissemination and adaptation of its concept, thus one of the central



tasks for the near future will be the distribution of the project and its usage by educators and researchers within different settings (e.g. HE institutions, research centres, and rapidly developing study suites in museums and galleries). Unquestionably, it would require certain efforts, due to a present lack of integration between print and digital media - the academic community and the publishing industry remain wedded to the traditional print format (Barlow, 2005). However, nowadays, textbooks are already appearing with CDs or DVDs as a means of support, meaning that digitalization is on its way.

It could be argued that in the near future theatre scholarship is likely to turn to technologies of computation, which would require theatre scholars and creative practitioners to become much more technology confident than they are at the moment. Traditionally, they exclude themselves from the technical aspects of theatrical production, relying on technicians to accomplish their ideas. But how can you invent something new without being acquainted with the medium? Digital technologies can transform the educational techniques used in contemporary theatre studies classroom from 'ones that tell about the medium to ones that use the medium directly' (Barlow, 2005, p. 139).

### **7.3 Concluding Remarks**

Even amongst the most committed education-development professionals, who may be fully aware of the benefits of computer-based education, it is not uncommon for their interest to fade because of difficulties in implementing novel digital teaching products. Agreeing with the benefits of e-learning and establishing it as a knowledge delivery platform are two different matters. Policy making, planning and e-resources allocation are often viewed as benefiting some



‘universal’ learner, without regard to a concrete place and time. This study attempted to facilitate an awareness of what kinds of digital products and projects already exist for theatre students, researchers, and practitioners. This could be a potentially significant investment in partnership and networking, encouraging continued effort on the part of those who are interested in the development of future innovative educational means and practice-based applications.

I would like to believe that the visionaries of the last century, such as Norman Bel Geddes, Adolphe Appia, Max Reinhardt, and Edward Gordon Craig ‘would have used computer technology if they could have, as they considered the components of performance in abstract terms: light as tone, intensity as color, stage space as volume, direction, mass and texture. All of these form the language of digital space’ (White, 2006, p. 96). So, presuming that such great figures would have, why would not we?



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- DigiCULT Technology Watch Report 2 (February 2004). Available:  
<http://www.digicult.info/pages/techwatch.php>



- The THEATRON Report, Version: TD1.4.1 (October 10, 2001).

## WEB RESOURCES

- <http://archeoguide.intranet.gr/project.htm>
- [http://www.blasttheory.co.uk/bt/work\\_desertrain.html](http://www.blasttheory.co.uk/bt/work_desertrain.html)
- <http://www.cs.waikato.ac.nz/~cbeardon/>
- <http://www.cs.waikato.ac.nz/~cbeardon/VA/index.html>
- The Columbia Electronic Encyclopedia (2006) Sixth Edition, Columbia University Press. Available: <http://www.columbia.edu/cu/cup/cee/cee.html>
- <http://www.arena.kth.se/desert.html>
- The Façade Project. Available: <http://www.interactivestory.net/#facade>
- The Institute for the Explorations of Virtual Realities at the University of Kansas: <http://www.ku.edu/~mreaney/flute/>
- King's Visualization Lab: <http://www.kvl.cch.kcl.ac.uk/>
- <http://www.panoguide.com>
- <http://searchnetworking.techtarget.com/>
- The Second Life virtual community – <http://secondlife.com>
- [www.theatron.org](http://www.theatron.org)
- [www.vitruvius.ac.uk](http://www.vitruvius.ac.uk)
- <http://www.web3d.org/>
- <http://en.wikipedia.org/>



## APPENDIX ONE: EMPLOYING VIRTUAL REALITY APPLICATIONS

There are numerous VR techniques and languages, such as Bubble Worlds, Virtual Reality Modeling Language, X3D, Java3D, which are employed for presenting virtual environments to the viewers. *Bubble Worlds*, for example, is a large selection of application packages created with standard camera and computer equipment. This is one of the easiest and cheapest ways to create virtual environments and landscapes, for example, for guided walks. This simple technique is a sequence of overlapping photographs taken from a single point; and it is ideal for giving the general impression of a VR place. Usually, no special training and hardware are needed to design bubble worlds (additional information can be found on <http://www.panoguide.com>).

Virtual Reality Modelling Language (VRML) is a 3D-file format for computer-generated environments and, at the same time, a scene description programming language that is also designed for the Internet applications (additional information can be found on <http://www.web3d.org/vrml/vrml.htm>). Recently, VRML has been replaced by a new 3D open standard – X3D – a next generation programming language, which defines a runtime system and delivery mechanism for real-time 3D applications running on a network. It supports several file-format encodings and programming languages, providing unsurpassed interoperability for 3D data and significant flexibility in manipulating, communicating and displaying computer-generated scenes interactively. X3D incorporates the latest advances in graphics hardware, compression and data security to provide the best performance and visual impact in an extensible architecture that supports ongoing evolution. X3D's XML-encoded scene graph enables 3D to be incorporated into web service architectures and distributed



environments, facilitating the movement of 3D data between applications. X3D is aiming to overcome the limitations of VRML, and to provide a fully specified quality (more information can be found on <http://www.web3d.org/>). Another alternative to VRML is Java3D, a low budget solution, which allows its developers to create VR applications that can be distributed across a number of delivery platforms.

There are many technological devices that are used for viewing, interacting and navigating virtual objects and environments. For example, Head-Mounted Displays (HMDs), Binocular Omni-Orientation Monitors (BOOMs), Cave Automatic Virtual Environments (CAVEs), input devices and other sensual technologies. The following descriptions of the above devices are adopted from Beier (1998), with kind permission from the University of Michigan Virtual Reality Laboratory.

A typical HMD (Fig. 29) houses two miniature display screens and an optical system, which channels the images from the screens to the user's eyes, thereby, presenting a stereo view of a virtual environment. A motion tracker continuously measures the position and orientation of the user's head and allows the image-generating computer to adjust the scene representation to the current view. As a result, a viewer can look around and walk through the surrounding virtual world.



FIGURE 29: Head Mounted Display (HMD). Source: <http://en.wikipedia.org/>



The BOOM (Fig. 30) is a head-coupled stereoscopic display device. Screens and optical system are housed in a box that is attached to a multi-link arm. The user looks into the box through two holes, sees the virtual world, and can guide the box to any position within the operational volume of the device. Head-tracking is accomplished via sensors in the links of the arm that holds the box.



FIGURE 30: Binocular Omni-Orientation Monitor. Source: <http://en.wikipedia.org/>

The CAVE (Fig. 31) provides the illusion of immersion by projecting stereo images on the walls and floor of a room-sized cube. Several persons wearing lightweight stereo glasses can enter and walk freely inside the CAVE. A head tracking system continuously adjusts the stereo projection to the current position of a leading viewer. The name is also a reference to the *Allegory of the Cave* in Plato's *Republic*, where a philosopher contemplates perception, reality and illusion.



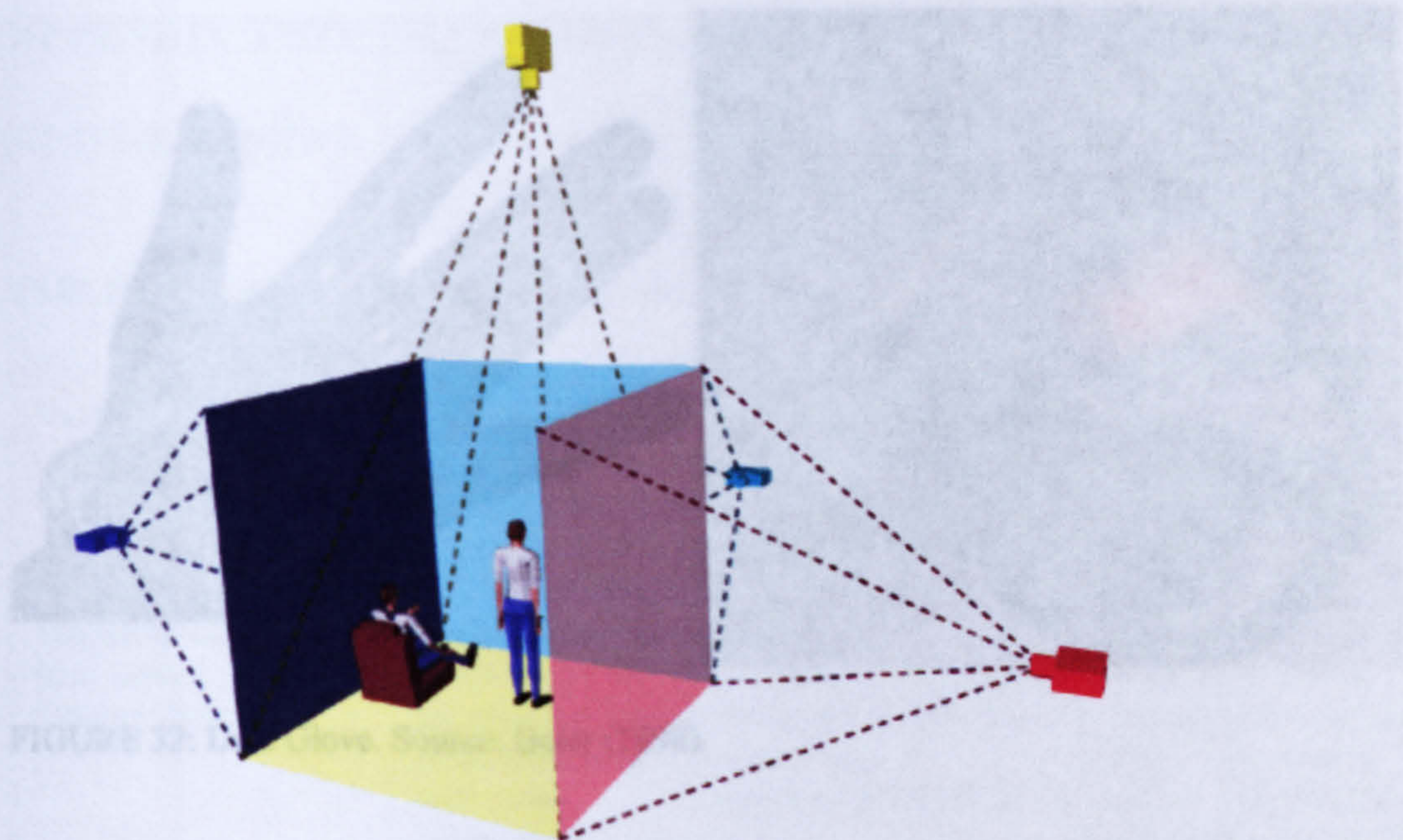


FIGURE 31: Cave Automatic Virtual Environment. Source: Beier (1998)

Furthermore, a variety of input devices like data gloves, joysticks, and hand-held wands allow users to navigate through virtual environments and to interact with virtual objects. Directional sound, tactile and force feedback devices, voice recognition and other technologies have also been employed to enrich the immersive experience, and to create more ‘sensualized’ interfaces. *The Wand*, for example, is the technical development of the computer mouse, presented as a spatial position and orientation sensor on a handheld stick. Bricken (1990) explains that it is typically coupled with voice commands and can be used to identify, attach, and move objects, to indicate a direction for flying, a location for teleportation or even as a pen for drawing, a knife, a switch or a spotlight.

VR gloves (Fig. 32) have the same purpose as wands, but are more complex devices. They consist of a tracker to sense the position and orientation of the user’s hand, and special flex sensors to measure the bend of the fingers.



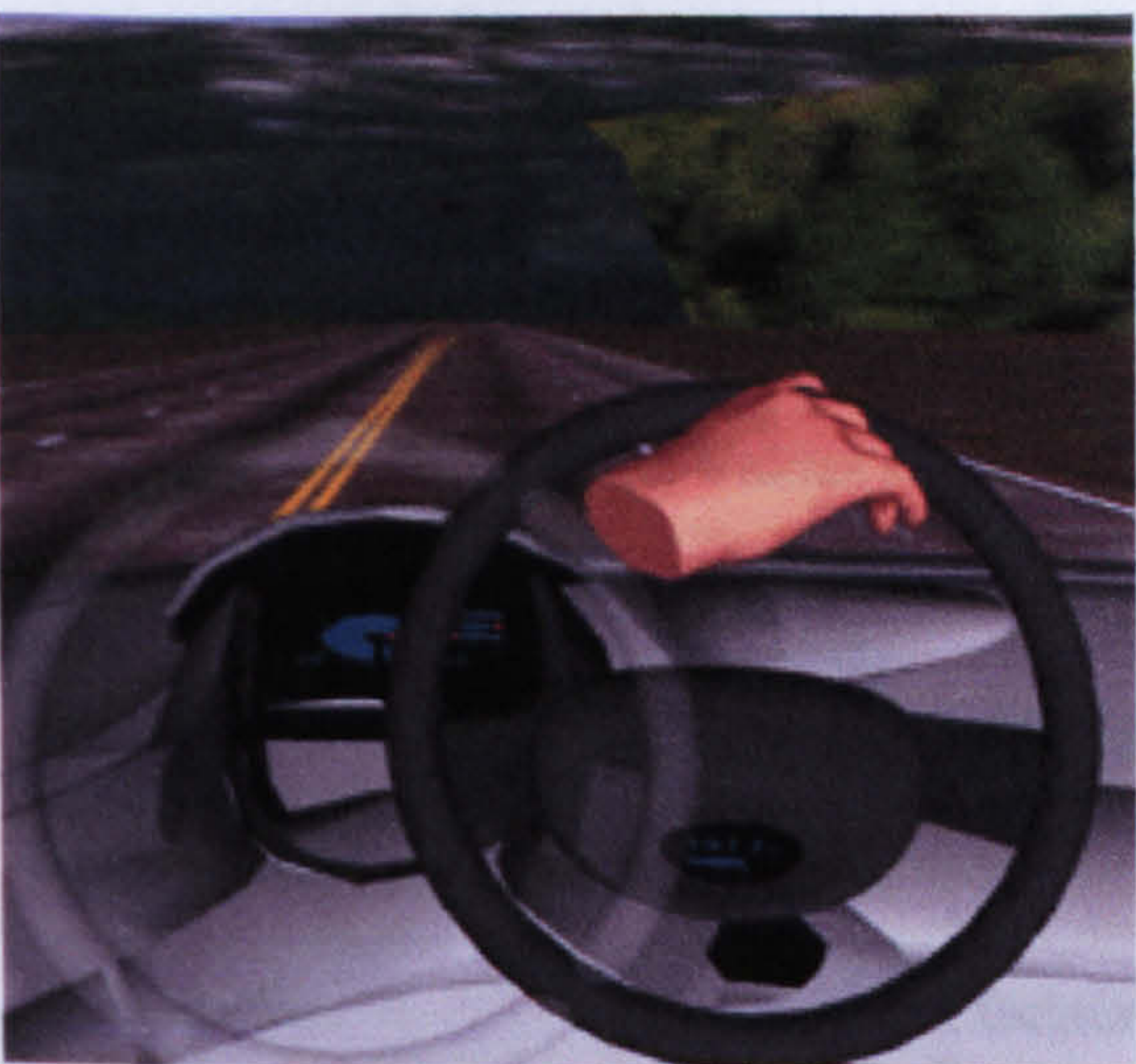


FIGURE 32: Data Glove. Source: Beier (1998)

Unfortunately, gloves tend to be expensive and difficult to use, mainly because the computer must be able to recognize intricate hand signals instead of a simple button press. Nevertheless, these realistic interactions with virtual objects through such devices, allow for flexible manipulation, operation, and control of virtual worlds. For more information refer to Beier (1998).



## APPENDIX TWO: PHASES OF COMPUTER-BASED TECHNOLOGY AND LEARNING

TABLE 10: Phases of Computer-Based Technology and Learning. Source: Valdez *et al.* (2000)

Variables	Phase I Print Automation	Phase II Expansion of Learning Opportunities	Phase III Data-Driven Virtual Learning
<b>Engaged Learning- Instruction- Student Roles</b>	Students use technology that automates print-based practices with some increase in active hands-on learning.	Students use technology to organize and produce reports, often using multimedia formats.	Students use technology to explore diverse information resources inside and outside school and produce information for real-world tasks.
<b>Engaged Learning- Instruction- Teacher Roles</b>	Teachers have limits on structuring the learning due to the closed-end design of the software. The quality of learning depends on the intended learning outcomes set by software developers.	Teachers use technology to access information, model problem-solving, and develop simulations that provide greater understanding of how technology is used in the work world.	Teachers continue to use technology to guide and engage students in self-directed learning activities. They model problem-solving that reflects real work but focuses on areas that are otherwise difficult to teach.
<b>Engaged Learning- Instruction- Grouping</b>	Amount and quality of collaboration is highly dependent on the design of the software.	Learning approach is individual, but the outcome is sharing a product with classmates.	Learning approach is a developmental process that is enhanced by working with others inside and outside the classroom.
<b>Engaged Learning- Content- Standards Based</b>	Content is usually focused on skills and inert knowledge with little attention to standards or research.	Content reflects research and best practices but is usually not linked to national standards. Technology use focuses on finding and presenting information.	Content reflects national standards, research, and best practices. Technology use is aligned with standards to enhance application of content learning to real-life situations.
<b>Engaged Learning- Content- Conceptual Integrity</b>	Segmented skills or knowledge are	Conceptual integrity is considered important, but analysis of key	Conceptual integrity is important; key understandings are



	emphasized without conceptual connections.	understandings is usually limited.	defined; and a variety of resources and strategies are linked to integrated concepts.
<b>Engaged Learning-Content-Authentic Tasks</b>	Design of the software determines whether work reflects real-world problems and resources. Printed resources convey established knowledge.	Students are given opportunities to make real-world connections, but because access to outside-building resources is limited, true real-world connectivity is superficial and forced.	Students have greater opportunities to access up-to-date, real-world resources and experts, especially through the Internet and other telecommunication resources; focus is on solving authentic tasks.
<b>Technology-Connectivity</b>	Limited to electronic print. Information is transferred via exchanges of portable diskettes.	Electronic print with some limited multimedia and networking capacity. Information transfer largely limited to connectivity tied to a hard drive in a building.	Multimedia and global telecommunications network infrastructure enables unlimited information transfer and online collaboration.
<b>Technology-Learning Access</b>	Few opportunities exist to take online courses. Distance education is lecture driven.	Some courses delivered to schools via videoconferencing, when access to qualified teachers is limited. Courses are traditional lecture mode with minimal interaction and summative evaluation.	Students and teachers any where can access learning experiences online as they need them; and engaged learning strategies are used in the instruction. Data-driven decision-making helps determine the flow of instruction and appropriate uses of technology resources.
<b>Systemic Integrity-Vision for Use of Technology</b>	Vision is focused on obtaining technology hardware and software. Little attention is given to changing learning strategies.	Vision is focused on increasing learning opportunities and strategies to better succeed in an information-rich world.	Vision is focused on increasing learning opportunities by using data to determine priorities and strategic use of resources.
<b>Systemic Integrity-Professional Development</b>	Sites provide technology-focused workshops emphasizing	Professional development is beginning to focus on instruction and learning, as the driver	Professional development is aligned with research and best practices, where teachers participate in



	<p>basic hands-on skills. Typically workshops are "sit-and-get." Teachers have little time to practice and have little access to ongoing support.</p>	<p>to designing technology-based units. Efforts are still limited by poor access to technology and a poor vision of learning.</p>	<p>just-in-time study groups, online seminars, action research, and collaboration with colleagues.</p>
<p><b>Systemic Integrity-Professional Development</b></p>	<p>There are few efforts to use technology to involve parents and the community.</p>	<p>Technology is used to inform parents and the community, but communication is limited primarily to technology-developed newsletters and multimedia presentations.</p>	<p>Web sites and interactive electronic systems are used to provide multi-tiered collaborations among educators, students, parents, and community members. Data-driven practices inform all levels of collaboration.</p>
<p><b>Systemic Integrity-Evaluation and Accountability</b></p>	<p>Many data-gathering efforts exist, but they are not tied to objectives. The results are not structured for technology use that would allow easy and customized analysis.</p>	<p>Objective data is available, but technology programs provide only district and classroom data, with little disaggregation of data for formative evaluation.</p>	<p>Technology data tools are used in classrooms that provide both formative and program information to teachers, parents, students, principals, curriculum directors, and policymakers, as appropriate for their individual and collective needs.</p>



## **APPENDIX THREE: THE ONLINE QUESTIONNAIRE FOR CASE STUDIES**

**This Online Questionnaire was conducted in August 2006 with Prof. Richard Beacham (Case Study One) and Prof. Colin Beardon (Case Study Two)**

### **Questions:**

**What is your overall evaluation of the THEATRON/VA project?**

- 1. Did the project fulfil all the intended goals? If not, what was difficult to accomplish and why?**
- 2. What could have been done differently in designing, promoting, and implementing the project, in order to improve its outcomes?**
- 3. Did the project change the way we perceive/create theatrical world or simply enhance existing scholarship?**

### **Answers:**

**Prof. Richard Beacham – August 15, 2006**

- 1. 'The goals were ambitious, of course. However, in the end the entire consortium responsible for the production of the module were very satisfied with the outcomes. These had also been regularly and rigorously reviewed by the EU appointed team of inspectors charged with evaluating the Project. The final outcome, in which all the intended goals were checked against what was actually achieved was "signed off" as having fulfilled (and in some cases exceeded) the proposed programme of work, and commended as particularly successful by the EU Project Officer charged with its oversight.**



There were some things that with better resourcing could have enhanced the Project. The use of virtual acoustics proved very challenging, and it was not possible to have this aspect for all of the theatre sites included in the module. Nevertheless, the outcomes did demonstrate quite positive “proof of concept” outcomes.’

2. ‘As always the challenge was resourcing and timing. The overall budget was not sufficient to cover adequately the cost of the work, and consequently all of the partners put in a very substantial amount of “extra” work on the Project, the costs of which they had to absorb. In retrospect, it might have been better to propose a more modest programme of work; indeed, in feedback and discussion sessions with other teams working on broadly comparable EU projects, astonishment (and admiration) was frequently expressed at how much we had taken on, and how well we had accomplished it! The Project also received international acknowledgement, chosen as a “Laureate” by the Computer World Honors programme for “visionary use of information technology”. A related problem was local institutional support. Only modest additional resources were made available to the Project during its programme of work by the Coordinating Institution (the University of Warwick), and almost nothing at all subsequently to assist in the exploitation or further enhancement to develop its outcomes and potential. Consequently, and very unfortunately, much of this potential remains unrealized, although it is now intended -- the primary development team having now moved to a different institution, King’s College London -- that this will be positively addressed in the near future.’

3. ‘It definitely has influenced how we perceive and create theatrical worlds (and their scholarly and pedagogical investigation), through its capacity to evoke



virtually, the constituent theatrical expressive elements of movement, space, time, and visualization. Surprisingly, despite the fact that the module is now several years old (and as noted above, has not had resourcing to improve or develop it further) there is nothing comparable available as a resource, elsewhere. Thus, even as a provocative example of the types of questions that IT technologies can help us to assist, the project continues to be valuable. We hope and believe that either it, or possibly future projects, in part benefiting from its example, will continue to explore and exploit the areas which it successfully opened up to discussion and investigation.'

**Prof. Colin Beardon – August 5, 2006**

1. 'From the design point of view, yes, it did achieve its main goal of enabling users to think about performance in a visual way, without necessarily getting involved in technical (staging) issues. What it did not accomplish was a large uptake, mainly because of the resources needed to launch a reliable product on a number of different platforms, and linking to other products through the use of dynamically evolving standards.'

2. 'I needed money to employ technical expertise to turn it in to a more reliable and usable product (as above). All my grant applications for this were turned down.'

3. 'I certainly tried to "change the way we perceive/create theatrical world" but it was aimed more at students of drama or amateur dramatics, rather than professionals. I think it also was successful, in that it demonstrated a lot of techniques, as how to design and build software for theatre people. '



## APPENDIX FOUR: THE EVALUATION OF THE THEATRON AND VA PROJECTS

### **The THEATRON project:**

The initial testing of the THEATRON application took place in spring 2000 at the Department of Computer Science, Faculty of Arts, Utrecht University, in the Netherlands. The students acknowledged the clarity of the navigation structure of the module, supported by the clearness of the textual resources, which also were generally considered as well-written. Although the models of the theatrical sites were mostly regarded to be interesting, some students, used to playing computer games with rendered environments had unreasonably high expectations of the 3D reconstructions. In addition, a wide range of opinions were expressed on the interface design of the THEATRON application, with some students giving a preference to the game-like appearance, and others describing the ‘academic-style’ design as more appropriate. Overall, the users learnt how to interact with the module and navigate the models reasonably fast, and also found the THEATRON resources more useful than conventional teaching materials.

In spring 2004, Professor Richard Beacham and Christa Williford, then a lecturer at the School of Theatre Studies, co-taught a *Performance Spaces* module to a small group of undergraduate students using the THEATRON application. In the evaluation of this module – *Implementing ‘E Support’ for Theatre Studies Students*, – which was published in the University of Warwick journal ‘Forum’, Christa Williford wrote: ‘it seemed natural that subject matter so revitalized by digital technologies should be supported by e-learning technologies as well, and so we put together a fairly extensive module website using SiteBuilder, into which



we placed large amounts of supplementary material.' Students defined the module website, as a 'key to its success'. They widely used additional resources and checked assignment pages fairly regularly; however, much less of their attention was paid to the optional student-centred areas, such as the module forum and the publishing section. At the end, Christa Williford acknowledged that:

...the preparation and use of online resources challenged us, as lecturers, to clarify our educational objectives and to focus even more closely upon our students' research and information management skills. In today's ever-expanding information culture, such skills are at the forefront of the rest of the School's curriculum and remain among the key values of a university education.

### **The VA project:**

The actual pilot test of the Visual Assistant was conducted in February 1998 at the Department of Theatre and Performance Studies in the University of Plymouth, and a follow-up session took place one year later. A group of about forty first-year undergraduate students was using the VA as a tool to create a set design for the first scene of one of four scripts. At the end of the software testing, two major criticisms were expressed. One of them was about the computer equipment, which was defined as 'below standard', thus affecting the quality of work, and even causing frustration amongst its users. The second criticism was entirely related to the VA software itself, describing it as being 'too simple' – i.e. lacking the complexity of levels and available images. It was also regarded as 'a theatre image-making sketch book, rather than as a theatre design tool.' Nevertheless, positive feedback was given to the simplicity of using the VA, which provided the



students with the possibility to concentrate on communication of the production ideas.

In October 1998 the VA software was further tested and assessed by a group of eighteen students in a five day workshop, held at the Malmö University College in Sweden. After the evaluation, the VA was generally considered as to be a background technology, whose main task was to support the process of the intellectual visualization of *A Dream Play* by Strindberg. The next VA evaluation took place in May 1999 at the Central St Martin's School of Art in the London Institute. During this three-week workshop, twelve second-year undergraduate students of the Set Design course were asked to create scenery for Büchner's play *Woyzech*, using the VA software together with the Virtual Stages application developed by Chris Dyer (Dyer 1999). During the workshop students were exploring various issues, for example, the act of movement, presenting it through the representation of a large number of objects, or a crowd of people. Others were more interested in producing high-quality architectural designs, or employing collage techniques as a major approach to creation of the sets. The capacity to manipulate objects in real time using the VRML files, was found to be very useful, but, unfortunately, underdeveloped because of the users' inability to scale the drafts or, in other words, because of the absence of the reference point (i.e. a human figure).



## APPENDIX FIVE: BIOGRAPHICAL SKETCH BY NORMAN BEL GEDDES

GEDDES, NORMAN BEL (ged'des), M.A., L.L.D., B.F.A.; designer, author, theatrical director and producer; born Adrian, Mich., 1893; son of Clifton Terry and Lulu (Yingling) G; student Cleveland School of Art, Chicago Art Inst.; married Helen Belle Sneider 1916 (deceased); children, Joan, Barbara; (2) Frances Resor Waite 1933 (deceased); (3) Ann Howe 1944 (divorced); Edith Lutyens 1953.

A pioneer of stage design in America 1914. Participated as designer, director, author or producer in 234 theatrical productions; Plays including '*Nju*', '*Papa*', '*Truth About Blayds*', '*The Rivals*', '*School for Scandal*', '*Julius Caesar*', '*The Patriot*', '*The Miracle*', '*The Eternal Road*', '*Lysistrata*', '*Hamlet*', '*Dead End*'; Musical comedies including '*Ermine*', '*Ziegfeld Follies*', '*Lady Be Good*', '*Fifty Million French Men*', '*Strike Up the Band*', '*Seven Lively Arts*'; Operas and ballets for New York and Chicago Opera Companies including '*Cleopatra*', '*La Nave*', '*Boudoir*', '*Iphigenia*'; Motion pictures '*Nathan Hale*', '*Feet of Clay*', '*Sorrows of Satan*'; Modernized 'Ringling Brothers Barnum & Balley' Circus performances and equipment 1940-42.

Introduced present-day method of lighting theatre stages with lens lamps in Detroit in 1914, in Los Angeles 1916, in New York in 1918. At age of sixteen, planned and built first theatre, Duplex Movie in Detroit. Has planned or designed 28 built theatres in America and Europe, including Theatre Guild, Roxy, in New



York; Ukrainian State Opera House in Kharkov; Copa City in Miami. Designer of buildings, restaurants, hotels, offices, stores, service stations, and homes.

Master-planned Toledo Scale factory 1929; City of Toledo 1944 (within six months of plan's being put on exhibition, \$226,000,000 was subscribed to put into effect, including the population voting 1% of their incomes for the following five years); Los Angeles Ambassador Hotel 1946; Boca Raton Hotel 1947; National Broadcasting Company TV studio operations 1951-6.

Architectural Commission Associate Chicago World's Fair 1929. In New York World's Fair, Central Motors Futurama building and exhibits 1938 (attracted 26 million persons into the building – more than half total attendance of the Fair – more than attended all baseball games in the country those two years – a larger audience than any movie ever had).

Founded Profession of Industrial Design and opened first office specializing in this subject in 1927, pioneering many firsts in industrial products: streamlined automobiles, Graham-Paige 1928; modern style store-window display, Franklin Simon 1929; radios other than wall cabinets, Taborette, in automobiles, portable, Philco 1930; streamlined railway train, Union Pacific 1931; streamlined ship 1932, not built; sheet steel all-white enamel stove, standard Gas 1932; adjustable chairs berths, toilets, galleys in Pan American planes 1933; prefabricated service station, Socony Vacuum 1934; puncture-proof tire, Firestone 1935; Ice Theatre, Rockefeller Centre 1937; Model Photography Illustration technique, Life Magazine 1941; electric typewriter, International Business Machines 1946.



Designed several thousand products for leading industrial manufacturers in fields of automobiles, boats, airplanes, household appliances, furniture, refrigerators, textiles, vacuum cleaners, tableware, jewelry; Merchandising methods store planning, store equipment, cash registers, meat-slicing machines, office equipment, office furniture, staplers, vending machines, self-service equipment, displays, exhibits, advertising campaigns, copy, layouts, illustrations, trademarks, type, typography, magazine and newspaper layouts, catalogs; Sculpted Silver Medal commemorating twenty-fifth anniversary General Motors Corporation 1933.

In the War, for US Navy: Originated technique of every type Surface Ship Identification; of World Wide Aircraft Recognition; Mark IV Submarine Trainer; Camouflaged Floating Submarine Bases (appeared to be icebergs or islands – harboring 2 supply ships, 8 subs); Training Films for Navy, Air Force, Coast Guard; Battle of Midway Official Record. For US Army: Rubber map processes for briefing landing forces; Sand-table map-making training technique; Palm-of-hand mapping technique for Infantry scouting; ‘Natural’ camouflage technique for Engineers Corps. For US Air Force: Portable self-camouflaged hangars and factories; Landfall target identification; Designed method equipment, buildings for Air Force Strategic Command Trainer; Psychological Warfare Weapons for Office of Strategic Services; Advisor on equipment to Quartermaster General USA; on maps to General Staff USA; on New York City Blackout to First Army Headquarters; to Office of War Information on propaganda; Member Inventors Council.



**Author of three books: 'A Theatrical Presentation of the Divine Comedy of Dante Alighieri', 1923; 'Horizons', 1932; 'Magic Motorways', 1940. Contributor to: Encyclopedia Britannica on Theatre Architecture, Stage Design and Industrial Design; and author of articles in numerous magazines. Originated 'Model Photography – Journalistic Technique' for Life Magazine.**

**Exhibited in museums of America, Europe, Africa, Asia since 1912. Represented in permanent collections of museums in America, Europe, and Asia. Member of Author's League, United Scenic Artists Union, Illuminating Engrs., Architectural League of N.Y., Royal Society of Arts (London), U.S. Naval Inst., Medieval Academy of America, Arquitectura de Mexico (Hon.), National Research Council; and others. Clubs: Players, Coffee House, North American Yacht Racing Union.**

**Norman Bel Geddes – 350 Park Avenue – New York – Plaza 5-9746**

**Norman Bel Geddes died in 1958.**



## APPENDIX SIX: *THE DIVINE COMEDY* PROJECT – OUTLINE OF THE ACTION

TABLE 11: *The Divine Comedy* Project – Outline of the Action. Source: The HRC, the University of Texas in Austin

<b>Sequence</b>	<b>1</b>	<b>The Opening (4 ¼ minutes)</b>
<b>Movement</b>	1.1	Auditorium light darkens
“	1.2	Lightening sound
“	1.3	Prayer in darkness
“	1.4	Dante’s appearance
“	1.5	Vision appears above
“	1.6	Vision vanishes
<b>Sequence</b>	<b>2</b>	<b>The Beasts (4 ¼ minutes)</b>
<b>Movement</b>	2.1	Sound of First Beast
“	2.2	Sight of First Beast
“	2.3	Sight of Second Beast
“	2.4	Sight of Third Beast
<b>Sequence</b>	<b>3</b>	<b>Coming of Virgil (7 ½ minutes)</b>
<b>Movement</b>	3.1	Virgil’s appearance
“	3.2	His offer to guide Dante
“	3.3	Second vision of Beatrice
“	3.4	Disintegration of Beasts’ eyes
“	3.5	Virgil describes Beatrice’s request
“	3.6	Virgil and Dante climb slope
<b>Sequence</b>	<b>4</b>	<b>Opening of Earth (7 minutes)</b>
<b>Movement</b>	4.1	Sounds in Earth
“	4.2	Cracking of earth into masses
“	4.3	Splitting up of masses
“	4.4	Receding of earth forms
“	4.5	Rising of earth forms
“	4.6	Breaking of forms
“	4.7	The earth opened
<b>Sequence</b>	<b>5</b>	<b>Descent into Inferno (3 ¼ minutes)</b>
<b>Movement</b>	5.1	Surface of ground becomes mobile
“	5.2	Recognizable as humanity
“	5.3	Dante and Virgil descend
<b>Sequence</b>	<b>6</b>	<b>The Eyes of Minos (3 ¼ minutes)</b>
<b>Movement</b>	6.1	Ribbons of light creep up the pit
“	6.2	First ribbon draws a figure downward
“	6.3	Second ribbon draws a figure downward
“	6.4	Third ribbon does likewise

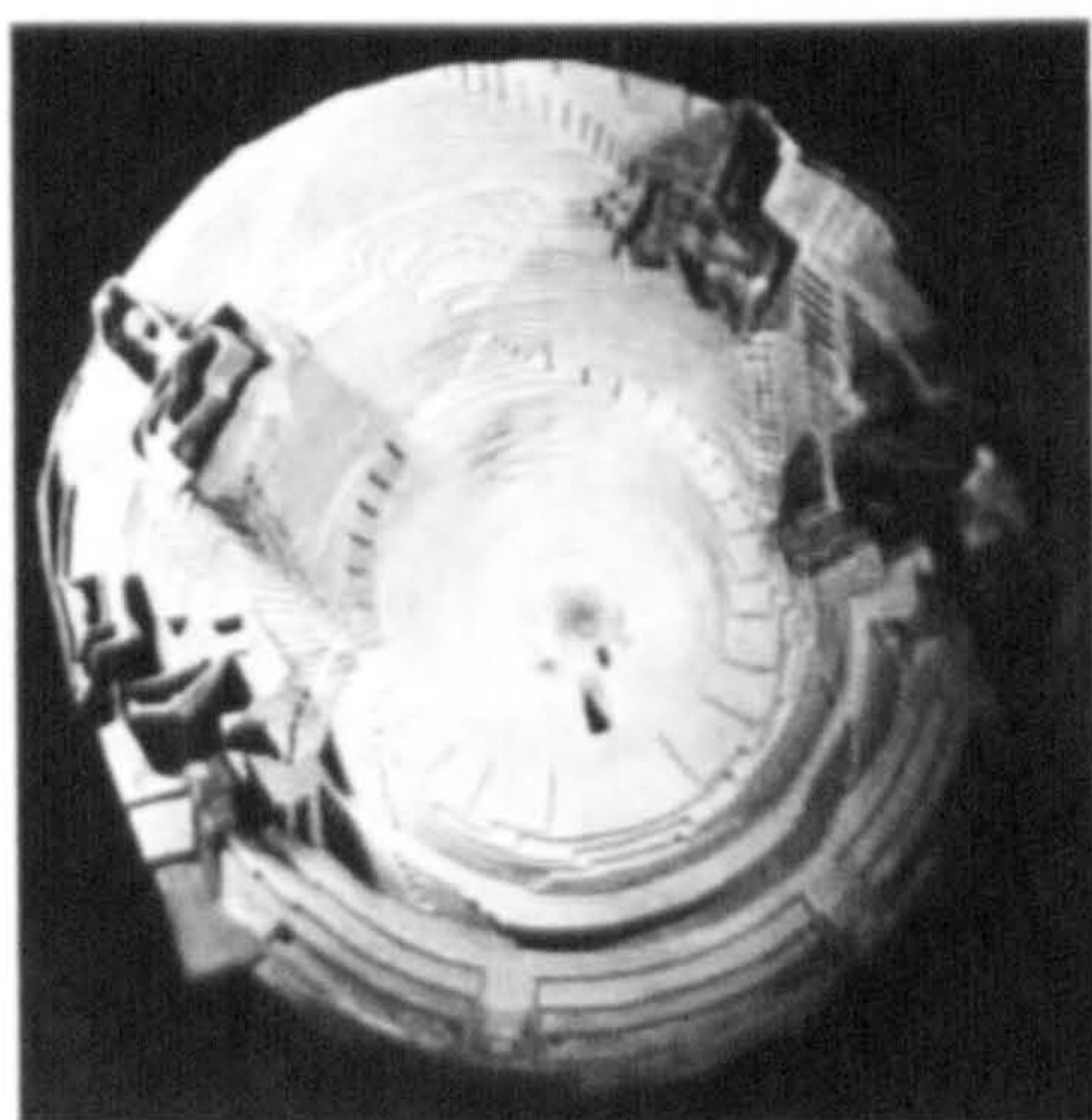


APPENDIX SEVEN: PLATES FOR A THEATRICAL PRESENTATION  
OF *THE DIVINE COMEDY* BY NORMAN BEL GEDDES

Photographs were taken by Francis Bruguière in 1922.

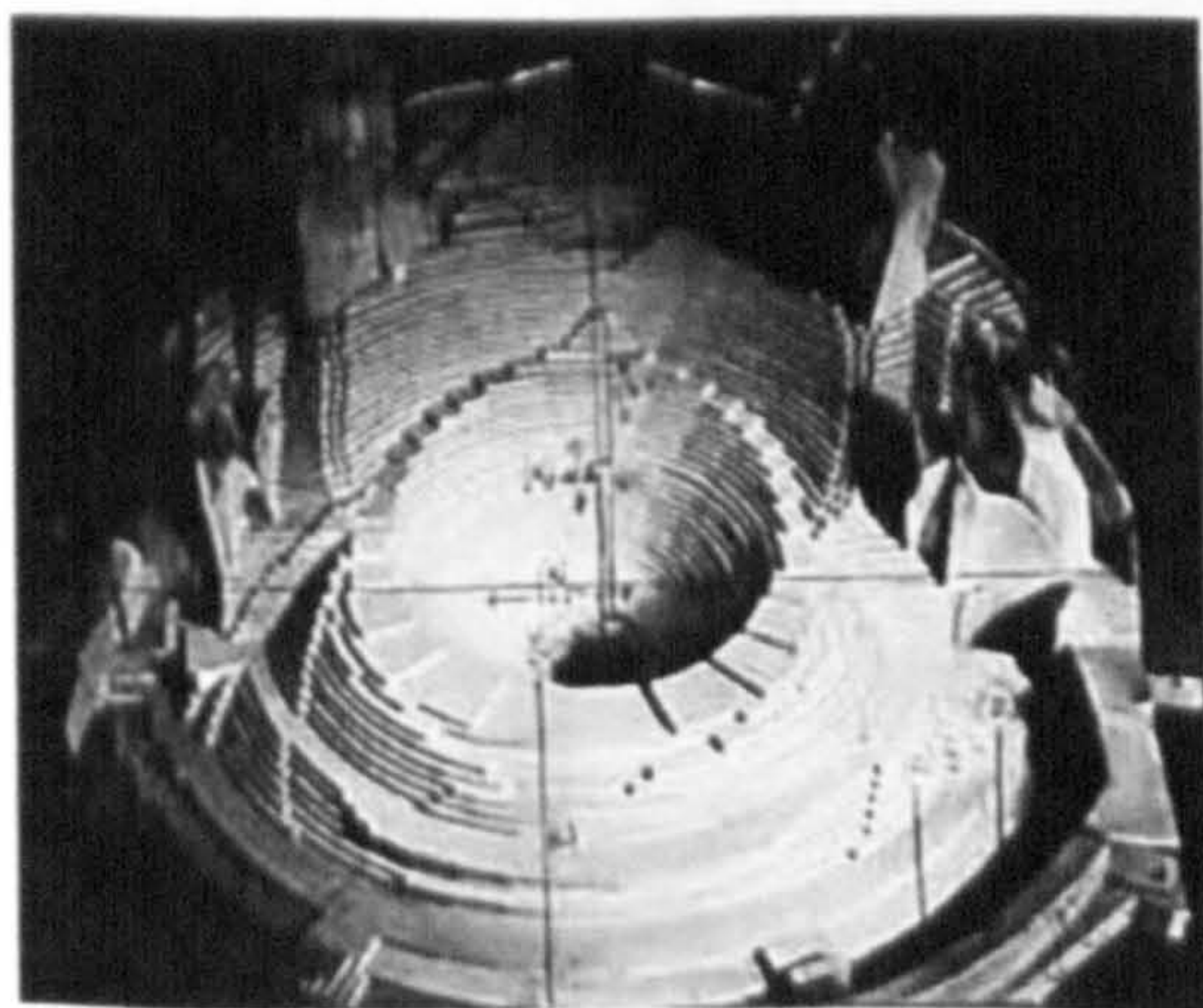
**PLATE ONE:** A view of the model of the stage for a theatrical presentation of *The Divine Comedy*. In the center is the pit. The location of the four towers, with the steps reaching the various levels in them is clearly shown, as well as the wall joining the lower towers. The photograph is from directly overhead.

‘O Muses, O lofty Genius, assist me!’



**PLATE TWO:** Another view of the stage from overhead, giving a more comprehensive idea of the relief. The ledge around the pit builds up through successive steps, to an elevation on the further side of twice the height of the near side.

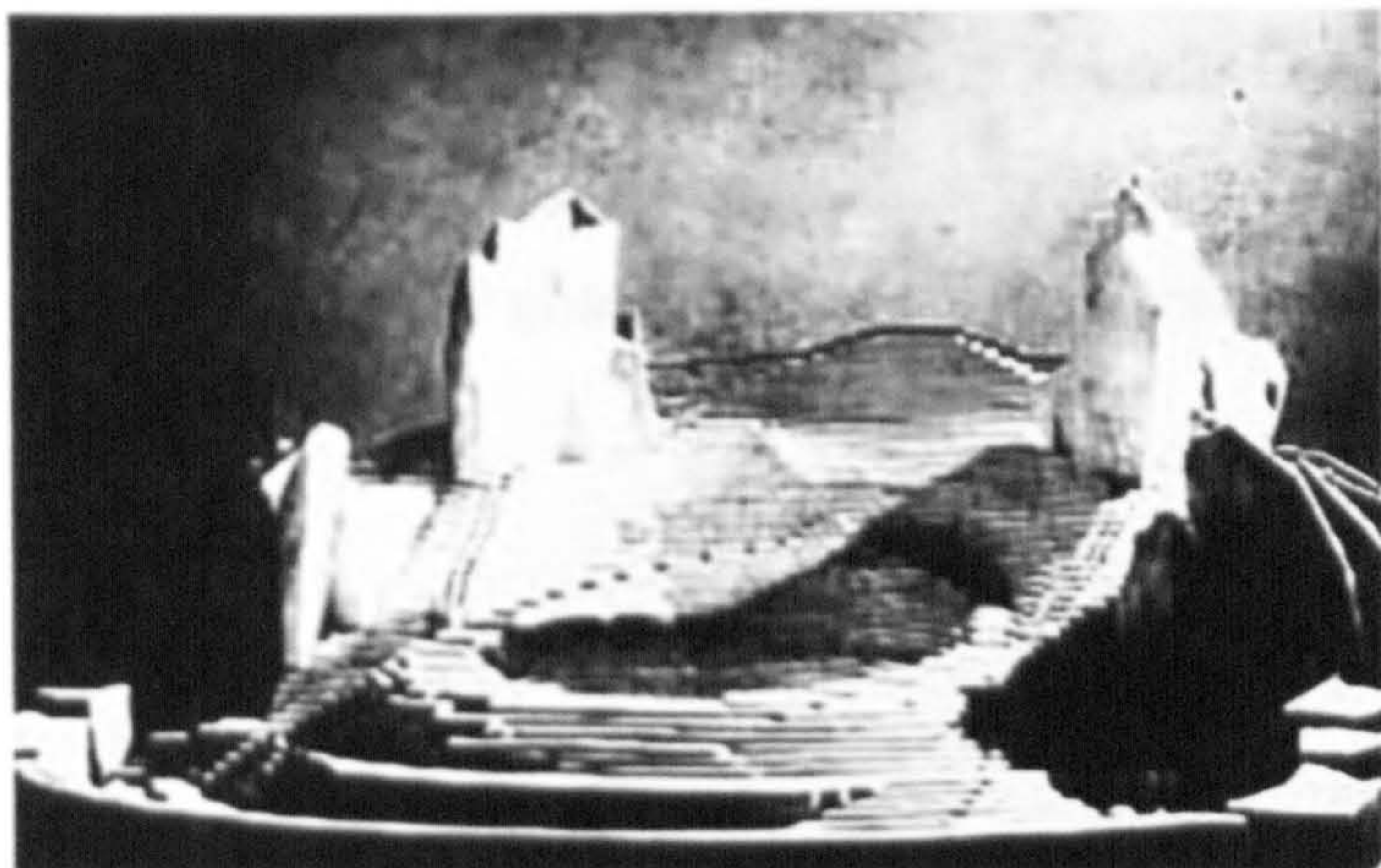
‘O honor and light of poets avail me and the great love which has made me search thy volume!’





**PLATE THREE:** The stage partially illuminated, illustrating the possibility of losing its outer edges in darkness.

‘One sole will is in us both.’



**PLATE FOUR:** The consciousness of the pit is at certain times undesirable. This lighting illustrates an instance of obliterating it.

‘A thousand steps and more we onward went in contemplation without a word.’

Same photograph as for the Plate Three.

**PLATE FIVE:** Although the stage is based upon a circle, there is not a curved line in it. The sweep of the steps is all done in angles. A more variable quality is gained by the many planes.

‘So was the bank that winds about the pit set with towers.’





**PLATE SIX:** When the performance starts the audience is in ignorance of the stage structure, which is in total darkness in direct contrast to the brilliantly illuminated auditorium. There is a penetrating sound as sharp as a flash of lighting. A glow of blue-green light reveals Dante standing on the wall. High above him a nebulous glow gradually takes on a form suggesting the figure of a woman, white and glistening. A vision of Beatrice.

‘Oh high the light, that leadeth me aright.’

The photograph could not be presented due to very poor quality.

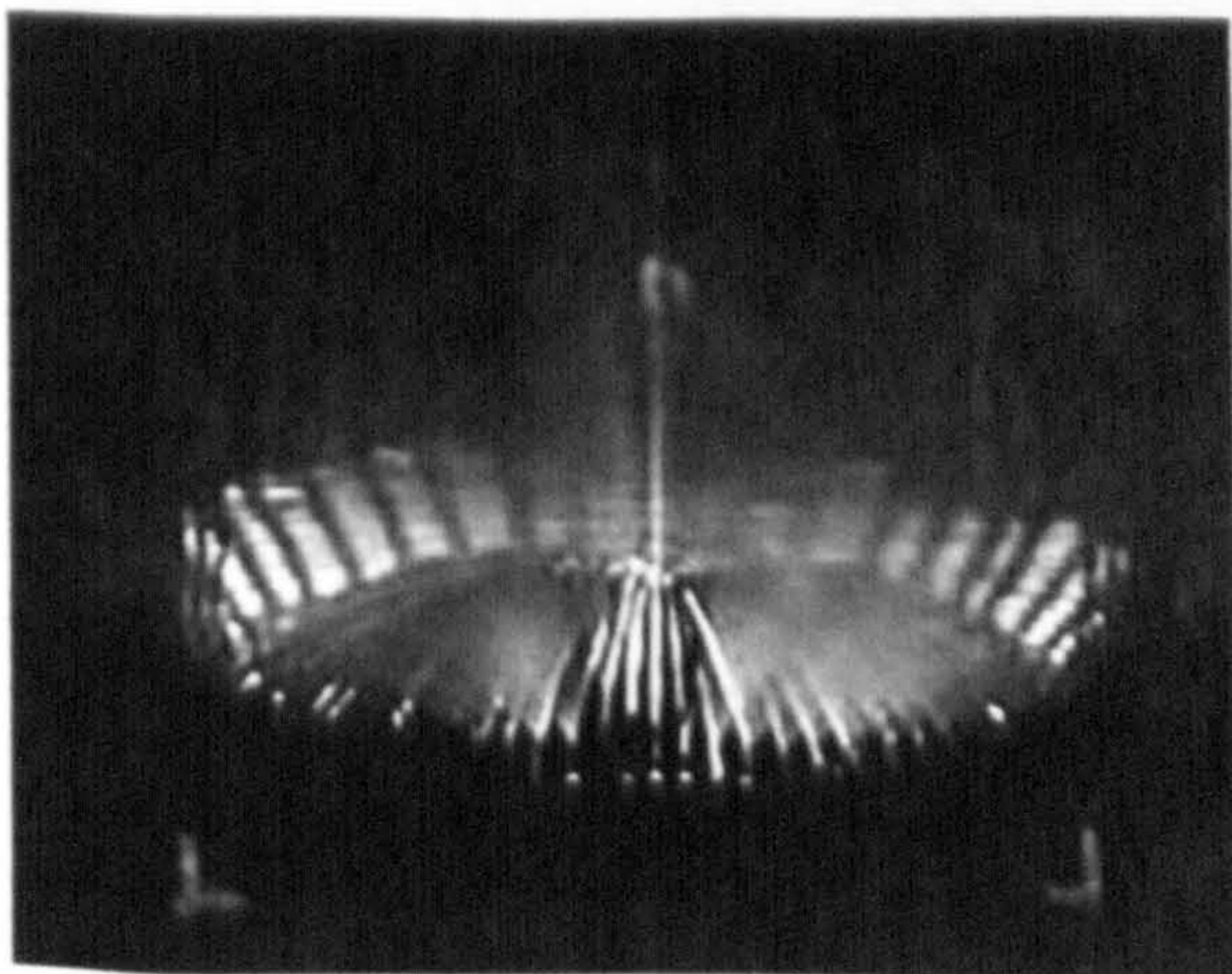
**PLATE SEVEN:** An addressing sound like heavy breathing. Two slits of fire, like blinking eyes, glow round and sway from side to side. Dante, awed, backs away. A second pair of swaying eyes comes out of the darkness. As they creep methodically nearer, Dante becomes terror stricken and runs almost into a third pair of eyes which appear directly in his path. Dante swoons. Virgil comes to him and quiets his fears whereupon the eyes of the beasts divide, subdivide spreading outwards, rise and ultimately become the stars overhead.

‘I deem it for thy best that thou follow me.’

The photograph could not be presented due to very poor quality.

**PLATE EIGHT:** There is a sound as of massive objects grinding against one another, as though the earth were cracking to its core. Dante, dimly visible in the background with Virgil, stands immovable as the glow of inner fire steps through crevices. The masses divide. The earth forms rise spasmodically.

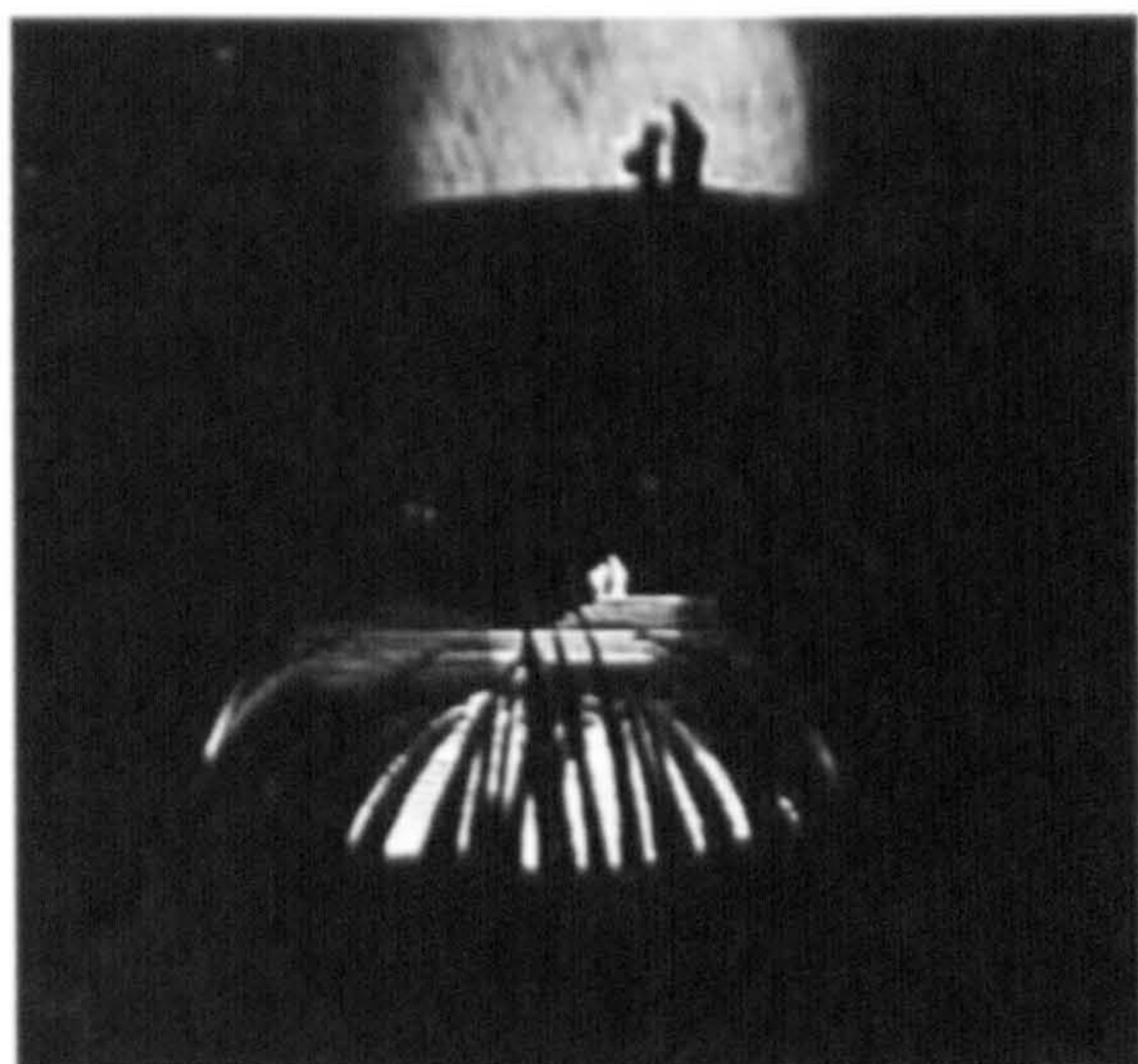
‘Now we descend into the blind world.’





**PLATE NINE:** The crevices widen. The light becomes more intense. Dante stands as though petrified. The earth forms rise in groups and divide into slender forms, like fingers on a hand, receding in all directions from the common centre. A faint murmur, as though coming from the bowels of the earth is perceptible, a vibration rather than a sound.

‘The way into the woeful place.’



**PLATE TEN:** As though wilting from the great heat the forms droop, crumble and collapse into the chasm and the outer darkness. The multitudinous hum of voices develops gradually into an insistent but rhythmic repetition, terminating in a word. The word is repeated. Another is introduced. Then both together. Then a third word. Then the three together. Finally the complete sentence:

‘Leave every hope, ye who enter!’

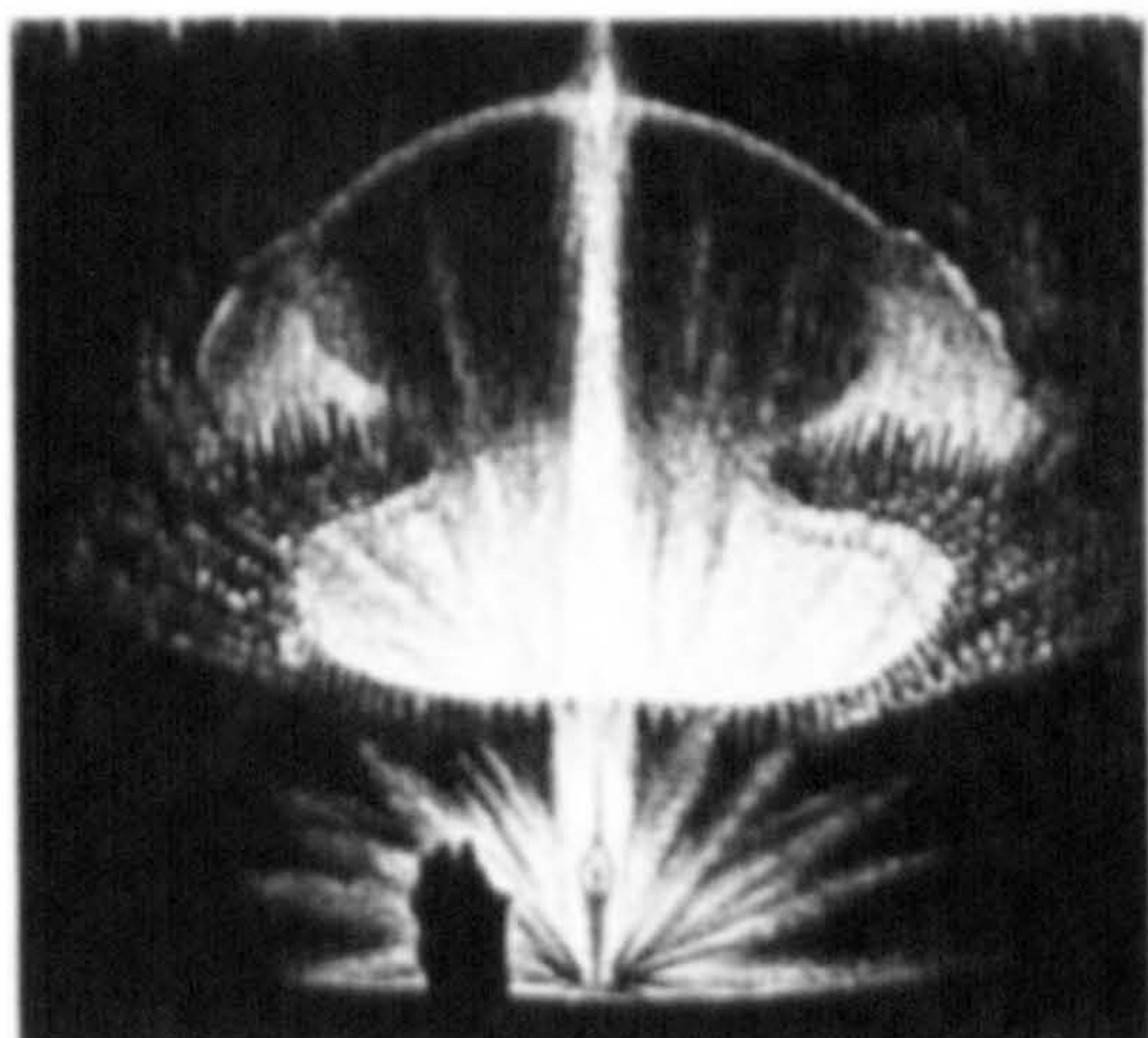


**PLATE ELEVEN:** All about the two figures the ground seems mobile, rising slowly and falling like the swell of the sea and with the same rhythm in sound.



Dante becomes sickened when he realizes, that what he took to be the vibration of the ground surface, is in reality the convulsions of decayed humanity. Unable to use their hand or limbs, they move and look like worms. Their color is so neutral that individuals are indistinguishable. When Dante asks if they are dead, Virgil answers:

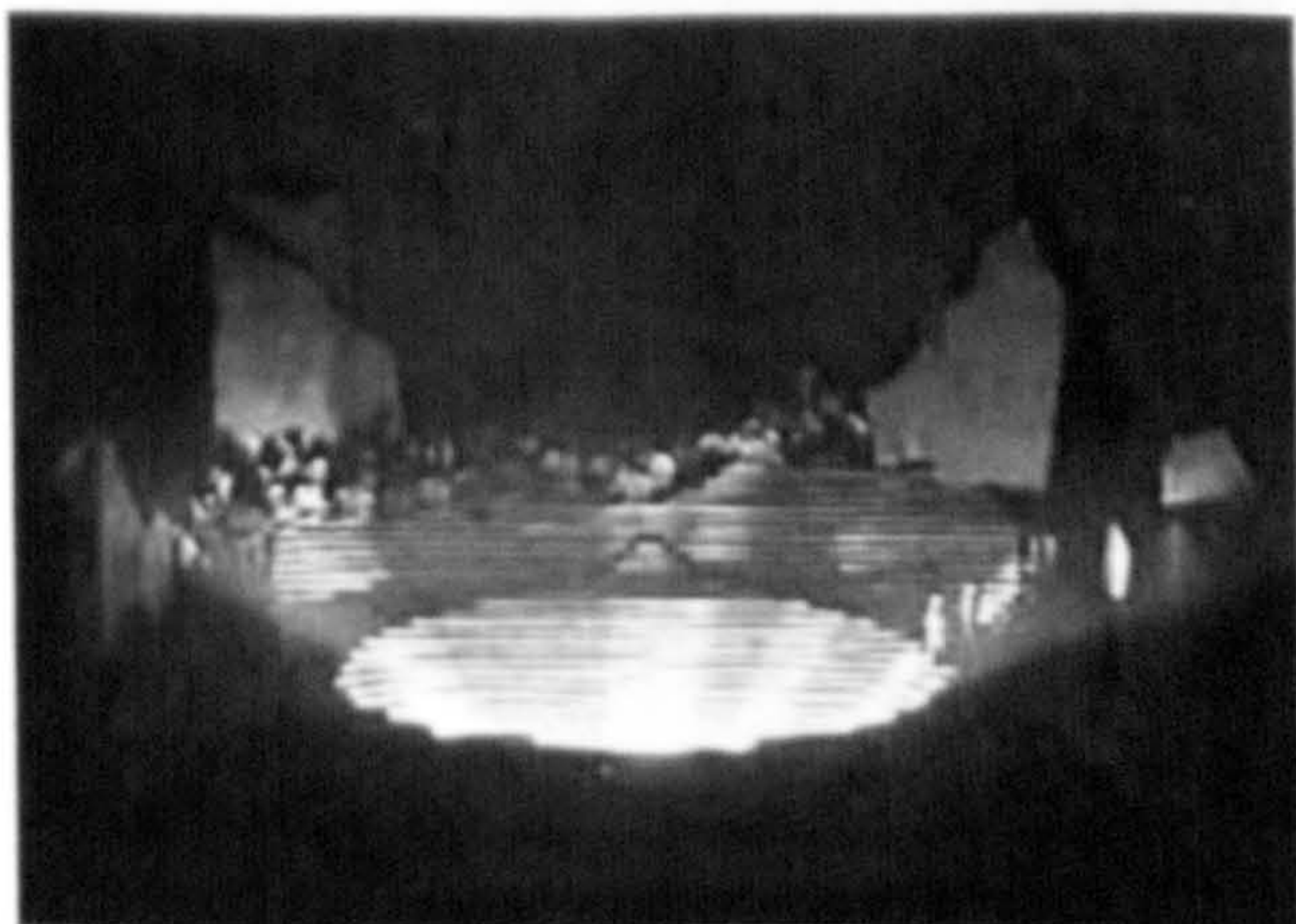
'In their blind life there is no hope of death.'



The photograph could not be presented due to very poor quality.

**PLATE TWELVE:** The lower part of the towers becomes visible. They rise out of the slope like giants, which Dante at first takes them to be. The yellow-green light has crept up the slope, bringing into relief a procession of weeping figures. Moving along in untold numbers, all in one direction, they finally cover the entire slope. Submerged in their midst Dante saddens with the realization that they are pairs of lovers.

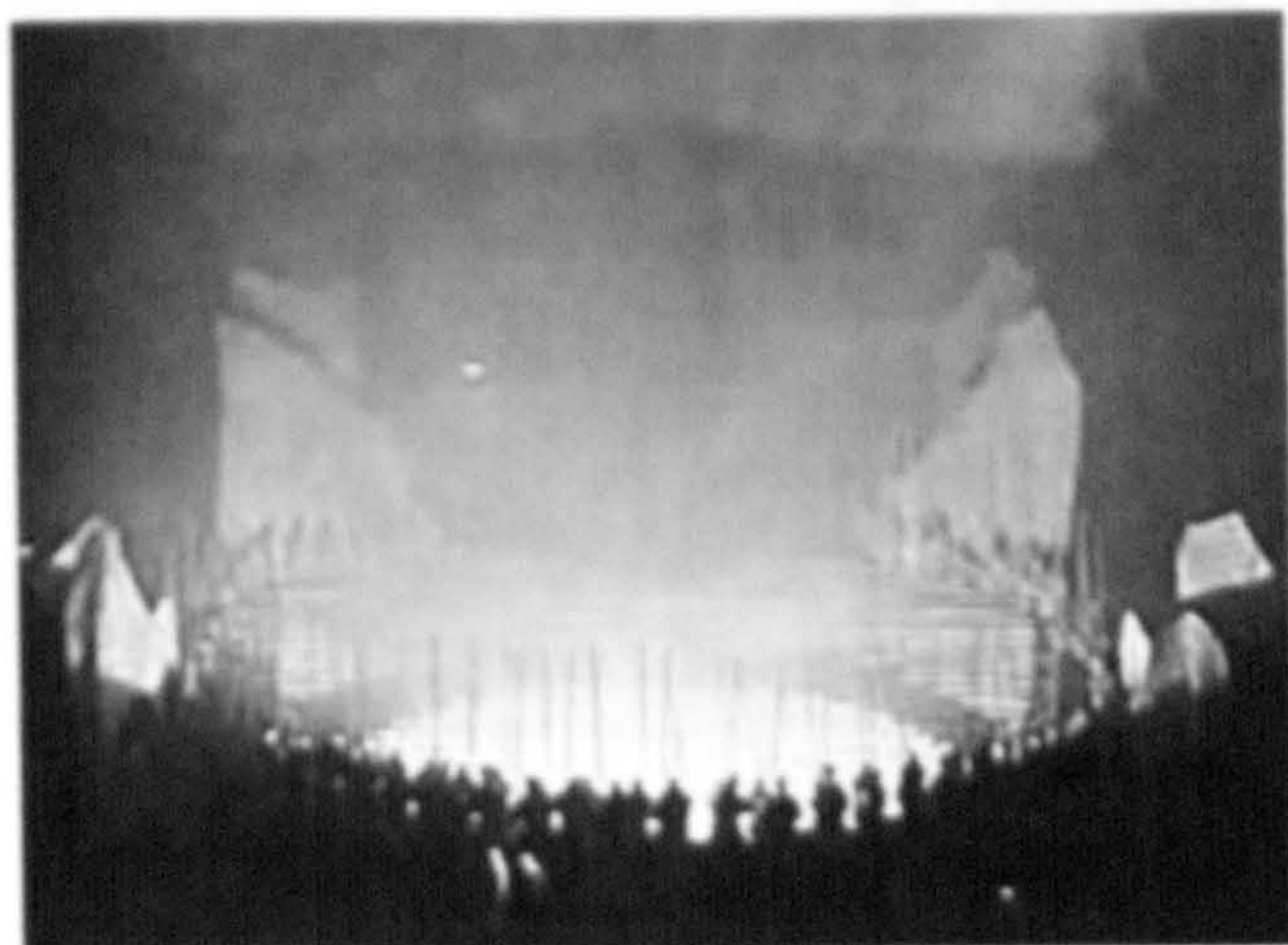
'Love, which absolves no loved one from loving, seized us so strongly, that it does not even now  
abandon us.'





**PLATE THIRTEEN:** The din of a shuffling multitude becomes a reality that forms a wall, challenging this living one a passage to their lower depths. As Virgil advances to debate with them, they too advance. When he stops, they stop. If he steps back, they do likewise. To enter the gate beyond seems impossible. The vision of Beatrice reappears and from it a bolt of light, and in the light a messenger from Heaven. With the sound of a tumult the heavy-footed ones scatter, as before a hurricane.

'The City named Dis, with its heavy citizens.'



**PLATE FOURTEEN:** From out of the shadow come silent, sobbing bodies, their heads on their breasts, stumbling, tumbling in their blindness, to the edge of the shadow. The stage is proportioned, so that each of its elements may be illuminated or not, as the varying action requires. The same consideration has been given to costumes and here is an example of how the figures may be lit to vary from apparent white to the black of those in silhouette.

'There is a place in Hell all of stone, the color of iron.'





**PLATE FIFTEEN:** Dante is unnerved when a winged figure jumps over his head from the tower behind him. In its claws is a limp body which it hurls towards the audience, into the darkness, and then jumps after it. Others follow, pouring from the top of the tower, down its sides, like weird shadows, that vanish in shadows.

‘Here the foul Harpies make their nest.’



**PLATE SIXTEEN:** As the Inferno episode progresses, the movement becomes more confused, and the beating of the vermillion light accentuates the identical rhythm in the sound. The winged Harpies scourge the crowd from behind. They fall and wail monotonously, but are driven on over the ledge into the black ditch where they disappear in a thick swirling fluid of deep red.

‘Fix thy eyes below, on the river of blood.’





**PLATE SEVENTEEN:** The slope is filled with figures turning round and round. The individuals gradually form into groups. Each figure in the group, as well as the group itself, turns in an orbit, passing through one another in the course of their circling. Eventually all these circular movements synchronize into one mighty rhythm. They move around the pit, slowly on the outside, faster towards the centre. Their path turns like a corkscrew, in streaks of intense hot color as they are sucked into the maelstrom.

‘Without a way or outlet from the fire.’



**PLATE EIGHTEEN:** The whole movement culminates when an iridescent glow spreads over the swirling mass like a great nebula and gradually brightens. Over all, small sparks of fire rain slowly down. The light begins in the heart of the pit, spreading over the stage and taking in the audience. Round and round it moves, the rhythm increasing until it reaches a point when it seems that we are swirling and that everything else is standing still. The nebula dissolves in darkness. The intermission follows.

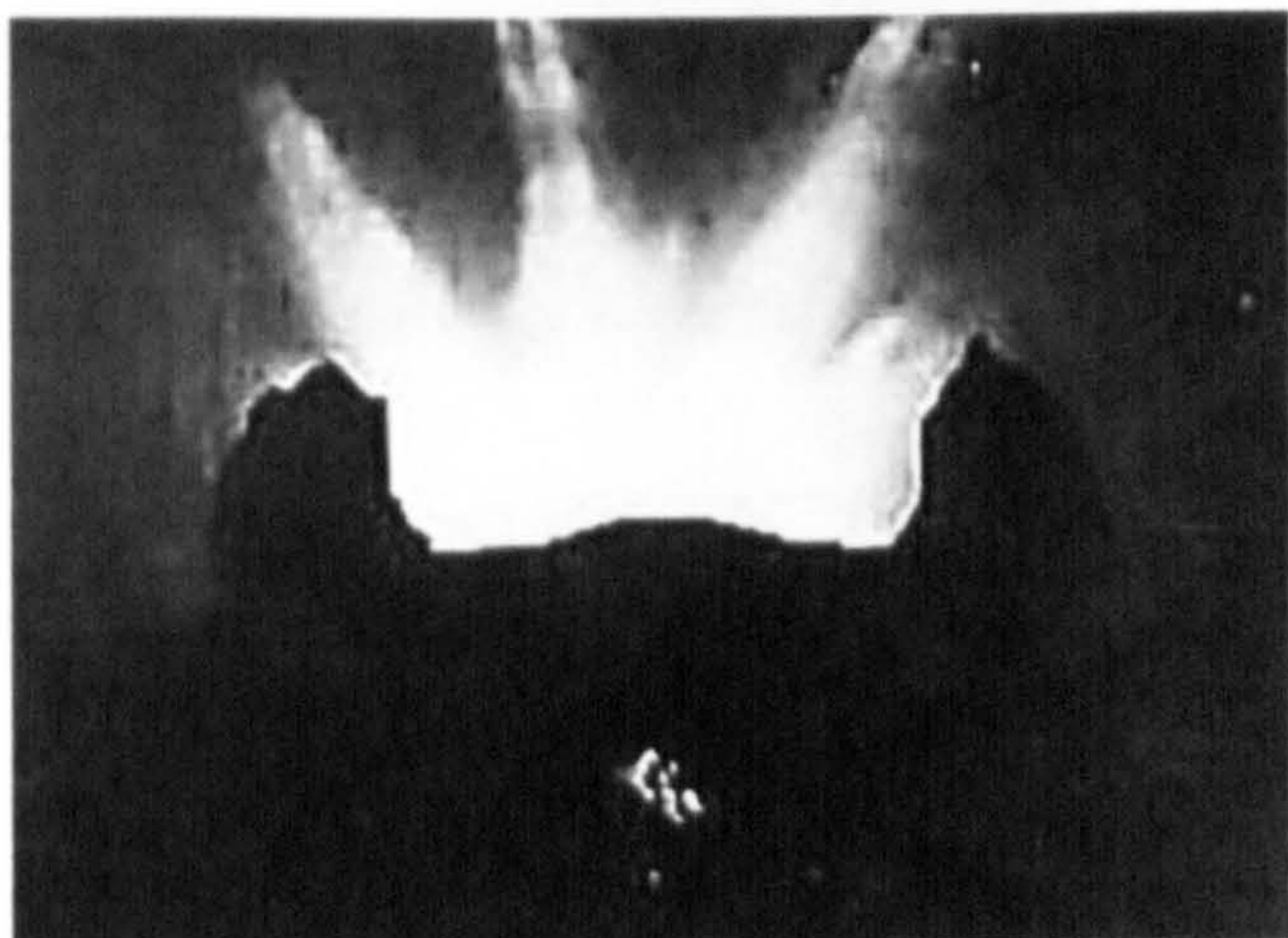
‘Thou knowest that the place is round and though thou art come far, not yet hast thou turned through the whole circle.’





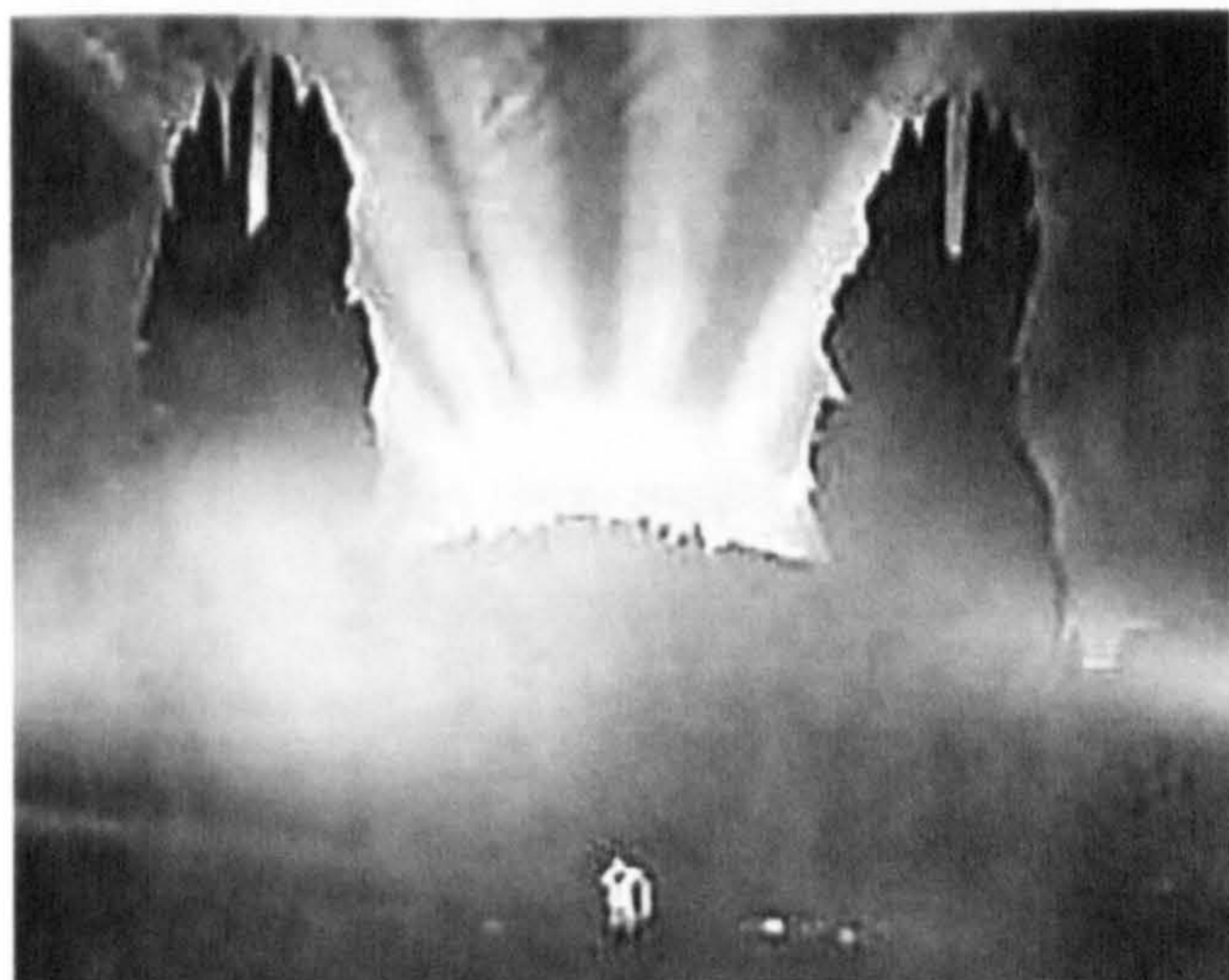
**PLATE NINETEEN:** Dante emerges from Inferno to Purgatory. As in the Inferno episodes all of the lighting came from the pit, so in Purgatory it comes from behind, and in Paradise from overhead.

‘A soft color as of sapphire in the sky renewed delight as I came forth from the dead air.’



**PLATE TWENTY:** The light has risen and divided itself more. The towers have taken on new forms, as of two winged guardians of Purgatory. Each part of these forms is the costume of an actor. There are twenty-five units to each tower, standing on varying levels. The wings can open and spread like a great bird.

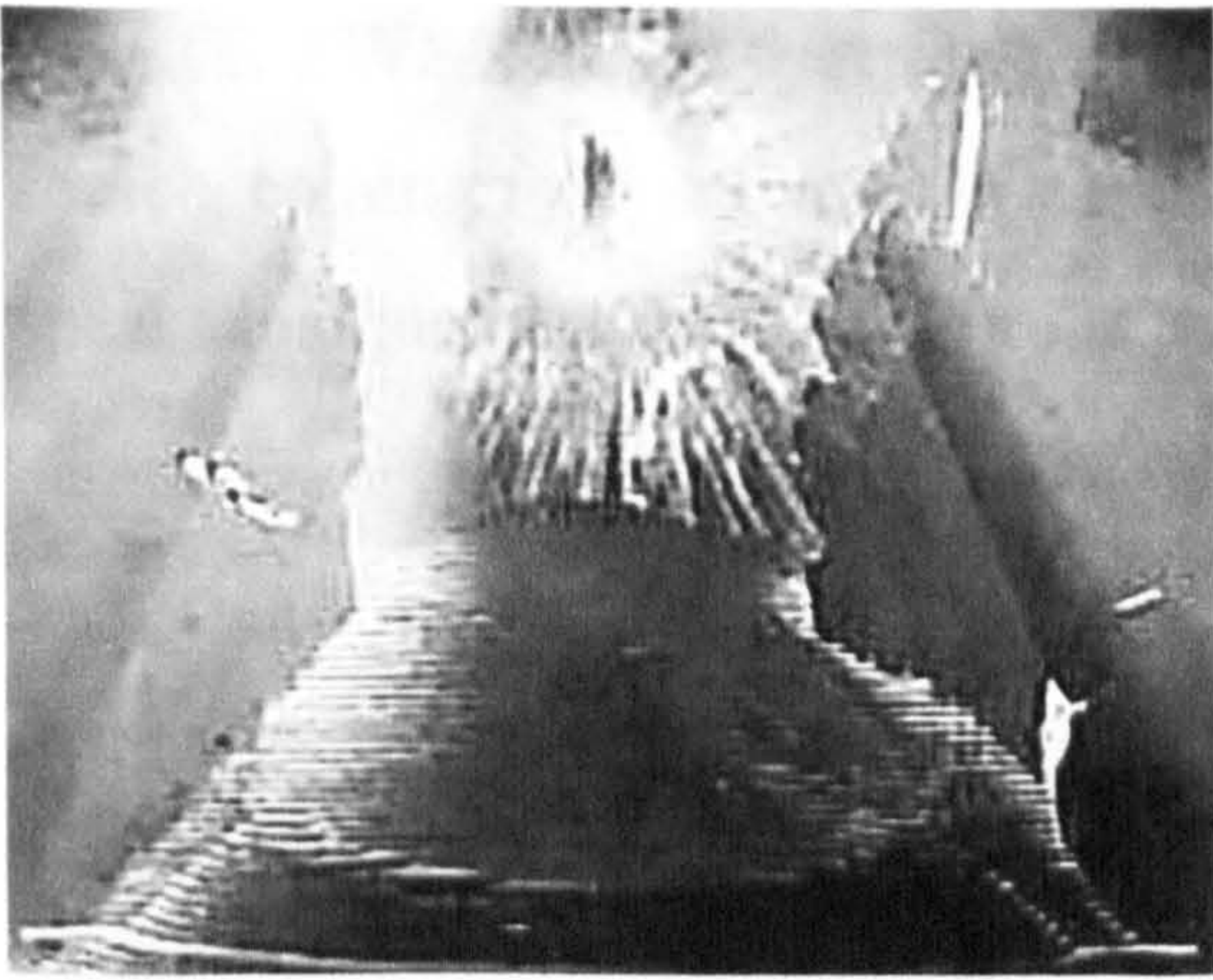
‘I saw poised in the sky wings, wide spread.’



**PLATE TWENTY-ONE:** The ascent of Dante in the sphere of eternal light.

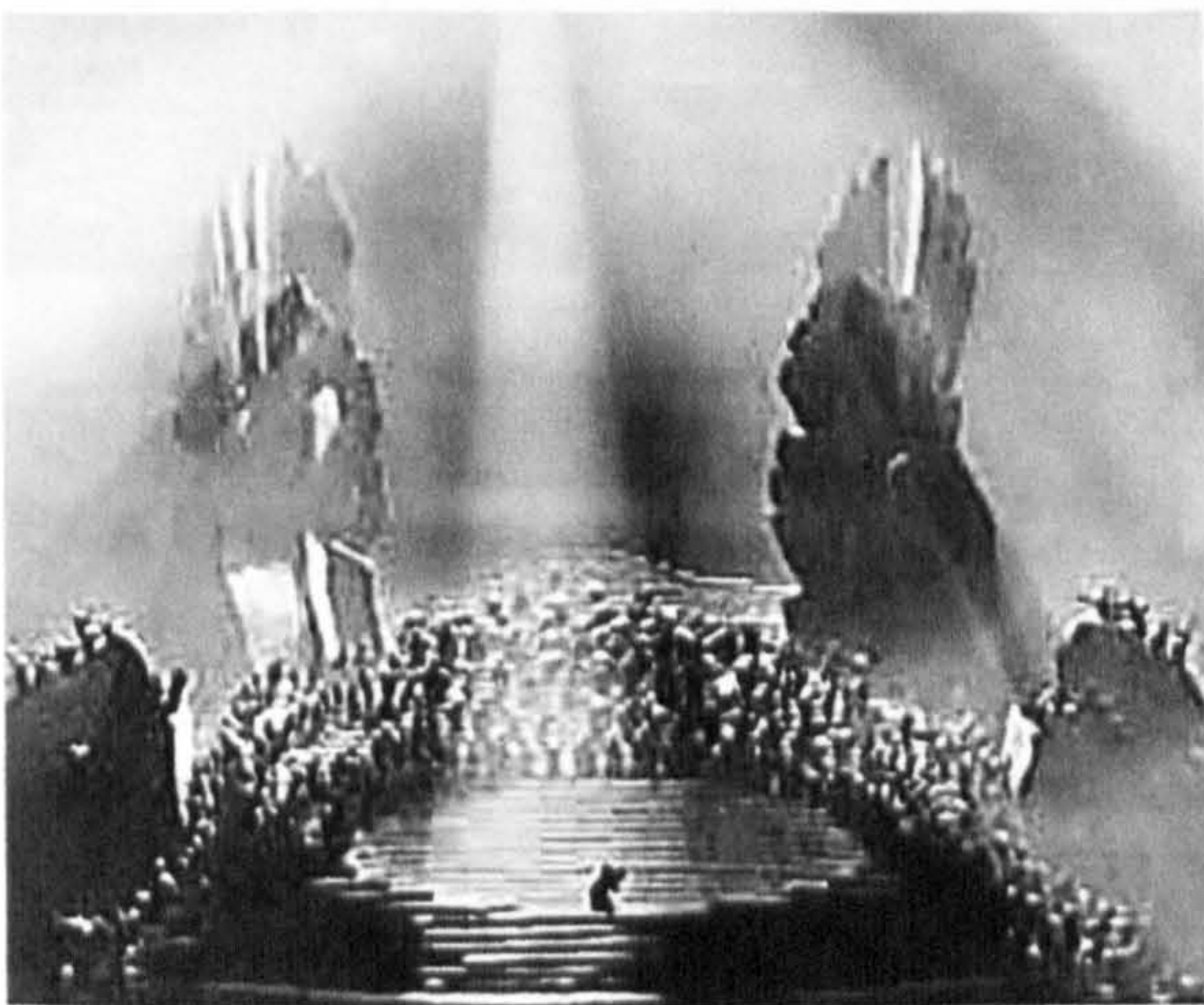
‘Love, who didst lift me with thy light.’





**PLATE TWENTY-TWO:** The light begins to come from overhead giving a silver iridescent quality to a stage that, when lit from below, was dark and heavy.

‘O! Thou sweet light upon this novel journey do thou lead me!’



**PLATE TWENTY-THREE:** Each shaft of light is a different color. The complete juxtaposition of all colors produces an intense but soft tone of the purest white. And here Dante meets Beatrice.

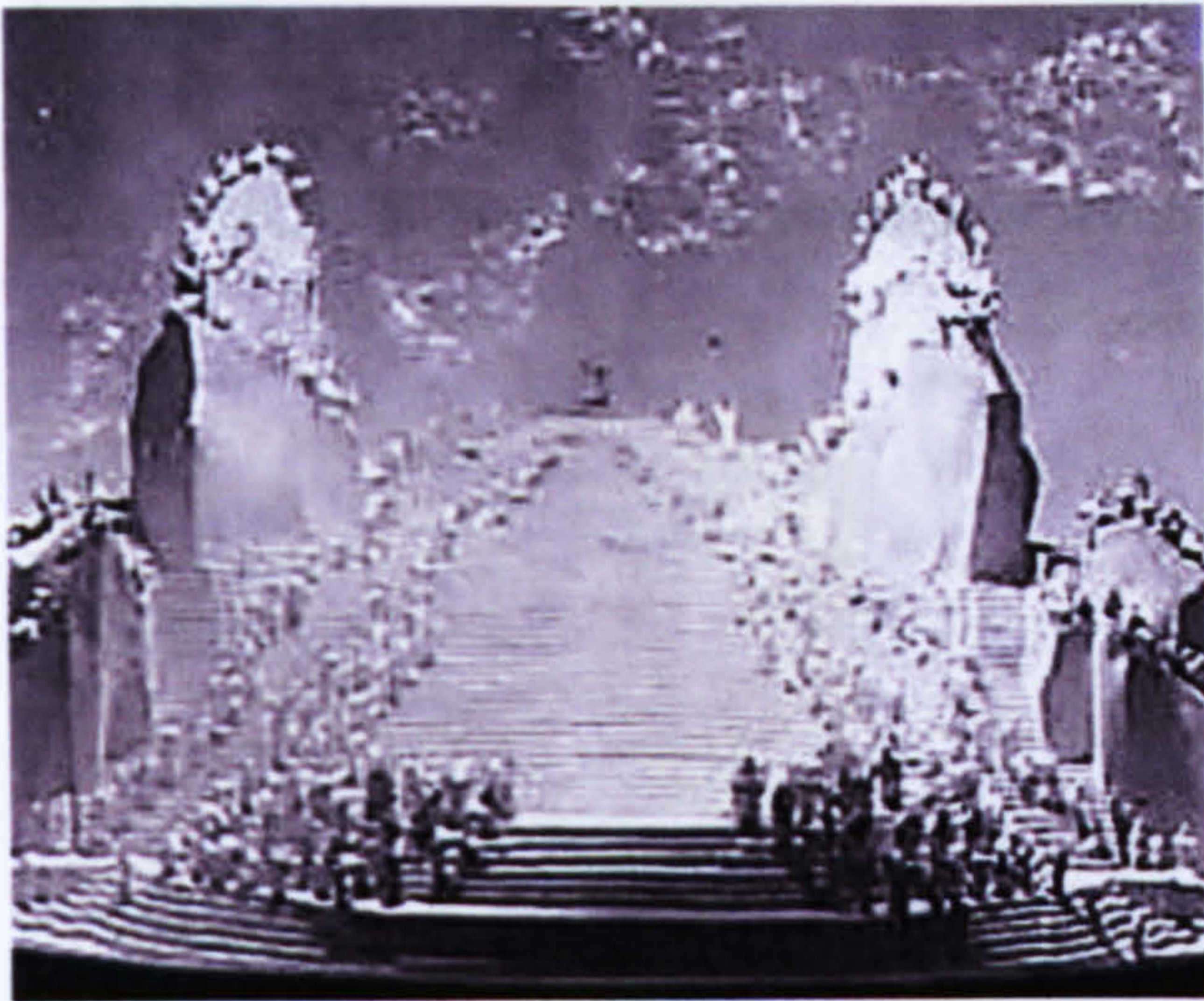
‘I saw the lady across the way although the veil which descended from her head did not allow her to appear distinctly.’





**PLATE TWENTY-FOUR:** As the final movement approaches, the light loses its source, coming from no point in particular but from everywhere at once. As Dante speaks his final words every lamp is turned simultaneously into the audience.

‘O abundant Grace, by the Eternal light, let my sight be consumed.’



**PLATES TWENTY-FIVE – TWENTY-EIGHT:** Dante uses eight masks. They develop in a sequence of emotion from a passive expression to a state of emotion beyond human experience. It must be remembered that the purpose of these masks is to convey expression at a distance of over a hundred feet. From the ensemble photographs it is evident that the form of the head itself is hardly seen, much less the features. The most intense exaggeration is therefore necessary. Virgil uses four and Beatrice two masks.

**DANTE’S MASKS** (drawings by Iryna Kuksa):





## **VIRGIL'S MASKS (drawings by Iryna Kuksa):**



## **BEATRICE'S MASKS (drawings by Iryna Kuksa):**





## **APPENDIX EIGHT: ONLINE QUESTIONNAIRE FOR MR. MARLEY PORTER (MP)**

17, May 2006

### **1. Could you please comment upon the acoustics of the Divine Comedy Theatre?**

**MP:** ‘The perfect dome geometry is one of the worst in directing sound, not to the audience, but to one point, in this case, some 30 feet above the floor and out in space.’

### **2. Could you please explain me how the acoustics of The Divine Comedy production would work?**

**MP:** ‘Acoustics is a very beguiling and demanding science but the principals are understood but practised by few. Essentially, a circular shape reflects sound waves back into a focal point. Not good for acoustics. Nor do walls want to be parallel because sound bounces back and forth. The best space is where walls flare away, non parallel as they move from the stage. Acoustical batting and sound attenuation are also critical in reducing the reverberation time. Buildings are actually acutely tuned for the particular use at hand. A perfect space would be flexible in walls and ceiling, to custom-design reflectivity ... but VERY expensive. Good luck!’



**APPENDIX NINE: QUESTIONNAIRE**

**School of Theatre, Performance and Cultural Policy Studies**  
**University of Warwick**  
**October 2006**

My name is Iryna Kuksa. I am doing PhD research on the use of visual computer technologies in the area of Theatre Studies.

This is an anonymous questionnaire to ask you about your opinion on the use of e-learning, software packages and digital technologies in the classroom. There is no right or wrong answer to any question, and I encourage you to be as honest as possible. The collected data will be treated confidentially. Your contribution would be very beneficial for the purposes of my research and I would appreciate you help very much.

If you are interested in the results of my research please do not hesitate to contact me on [I.Kuksa@warwick.ac.uk](mailto:I.Kuksa@warwick.ac.uk)

**INSTRUCTIONS FOR COMPLETION:**

- Please tick the box against the option which most closely represents your opinion;
- If there is a five-point scale than tick the box which you think most closely represents your views;
- Where there is a space to write, please write in BLOCK CAPITALS.

**SECTION 1: GENERAL INFORMATION ABOUT YOU**

**Q1. Are you ...?**

<input type="checkbox"/>	Undergraduate Year 1
<input type="checkbox"/>	Undergraduate Year 2
<input type="checkbox"/>	Undergraduate Year 3



**Q2. What is your particular area(s) of interest in Theatre Studies?**  
(mark any boxes that apply)

<input type="checkbox"/>	Modernist Theatre
<input type="checkbox"/>	Visualization and Scenography
<input type="checkbox"/>	Musical Theatre
<input type="checkbox"/>	Digital Technologies and New Media in Performance
<input type="checkbox"/>	Community Theatre
<input type="checkbox"/>	Performance Practice and Improvisation
<input type="checkbox"/>	Political Theatre
<input type="checkbox"/>	Dramaturgy Evolution
<input type="checkbox"/>	Theatre and National Identity
<input type="checkbox"/>	Performance and Text
<input type="checkbox"/>	Other (please specify)

.....

**SECTION 2: TECHNOLOGY USAGE**

**Q3. How can you describe your computer skills?**

<input type="checkbox"/>	I am computer-literate
<input type="checkbox"/>	I have very good computer skills
<input type="checkbox"/>	I am a frequent user but my skills need some more improvement
<input type="checkbox"/>	I have some computer skills but do not use computers too often
<input type="checkbox"/>	I do not use computers at all
<input type="checkbox"/>	Other (please specify)

.....



**Q4. For studying, do you use computers at home, your classroom or in your workplace? (mark any boxes that apply)**

<input type="checkbox"/>	Home
<input type="checkbox"/>	Classroom
<input type="checkbox"/>	Workplace
<input type="checkbox"/>	All above

**Q5. How useful would you find the following applications of technology, as part of your learning?**

	Totally useless 1	2	Very useful 3	4	N/A 5
MS Office (Word, Excel, Access)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PowerPoint presentations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using the Internet to find information	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using specialized software*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Accessing information from CD ROMs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Accessing information from DVD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using VCR/TV	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Following web links provided for extra information	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Downloading lecture notes from Intranet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Submitting work via email	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

\* i.e. software designed for those who study/research/work in the area of Theatre Studies (e.g. the THEATRON project)



**SECTION 3: RESOURCES**

**Q6. To what extent do you agree/disagree with the following statements?**

	Strongly Disagree			Strongly Agree	
	1	2	3	4	5
I like independent learning/study	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I find it helpful, if I can revise difficult bits	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Like to have things explained in sequence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Find it easier to study, if the instructions are provided	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prefer to work at times suited to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Like to have a teacher to help me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
More able to learn at own pace, than in class	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Like to have more time for reflection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prefer working in groups	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Q7. In the classroom I would prefer to ... (mark any boxes that apply)**

<input type="checkbox"/>	Be a spectator/listener/observer
<input type="checkbox"/>	Be an active participator
<input type="checkbox"/>	To have more theory
<input type="checkbox"/>	To have more practical exercises
<input type="checkbox"/>	To have more visual examples
<input type="checkbox"/>	To have an opportunity to be more creative
<input type="checkbox"/>	Other (please specify)

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SECTION 4: CONTENT

Q8. If you had access to the database with software materials relevant to the course you are doing, how much would you agree or disagree that ...

	Strongly Disagree			Strongly Agree	
	1	2	3	4	5
It would be more flexible	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It would be more fun	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It would be visually more stimulating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I would be able to remember more	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It would be more practical	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It would help me to be more reflective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It would help my learning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I would be able to do the work in my own time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q9. What type of electronic resources would you like to have access to during the class or while studying alone? (mark any boxes that apply)

<input type="checkbox"/>	Visual materials (photos, sketches, schemes) on theatre designs
<input type="checkbox"/>	Biographical sketches on authors/directors/designers/actors
<input type="checkbox"/>	Explanation/description of the set/action/lighting/music
<input type="checkbox"/>	Documentation (visual and textual) on the performance
<input type="checkbox"/>	3D (three-dimensional) reconstructions of theatre sets
<input type="checkbox"/>	Theatre glossary
<input type="checkbox"/>	Information on the alternative sources (e.g. links to other related e-resources)
<input type="checkbox"/>	Other (please specify)

.....

.....

.....



**SECTION 5: IMPACT AND LEARNING OUTCOMES**

**Q.10 To what extent do you agree/disagree with the following statements?**

Increased use of ICT (Information and Communications Technology):

	Strongly Disagree			Strongly Agree	
	1	2	3	4	5
... Will lead to more students continuing with the course	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... Will lead to better learning outcomes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... Will lead to better understanding of the course materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... Will make the course more interesting/engaging	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... Will provide easier access to the course material	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... Will help students get a job at the end of their studies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other (please specify)

.....

**Q.11 In your opinion which areas of Theatre Studies would benefit more from the greater use of visual technology? (mark any boxes that apply)**

<input type="checkbox"/>	Acting	<input type="checkbox"/>	Lighting Design
<input type="checkbox"/>	Theatre Design	<input type="checkbox"/>	Dramaturgy Evolution
<input type="checkbox"/>	Directing	<input type="checkbox"/>	History of Theatre

Other (please specify)

.....

**THANK YOU VERY MUCH FOR COMPLETING THIS  
QUESTIONNAIRE**



**APPENDIX TEN: THE SET-SPECTRUM PROJECT EVALUATION**

**Directions:**

The responses to each statement in this survey involve circling a number between 1 and 5. Please, read each statement carefully before deciding to which extent you agree with each of them:

1	2	3	4	5
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree

Thank you for taking the time to complete this survey! Your responses will remain confidential.

**1. The content is written clearly and concisely with a main idea. It is highly informative and provides essential information to the user.**

1	2	3	4	5
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree

**2. The project is presented in a consistent format, which extends page-to-page. Layout of the pages is clear and easy to follow.**

1	2	3	4	5
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree

**3. It was easy to interact with textual and visual materials and navigate through the pages.**

1	2	3	4	5
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree



**4. It was easy to navigate the 3D (three-dimensional) stage-model. The Help section includes useful tips on how to interact with it.**

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Strongly</b>	<b>Disagree</b>	<b>Undecided</b>	<b>Agree</b>	<b>Strongly</b>
<b>Disagree</b>				<b>Agree</b>

**5. I found the Study Corner section useful for testing the knowledge I gained through interacting with the Set-SPECTRUM project.**

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Strongly</b>	<b>Disagree</b>	<b>Undecided</b>	<b>Agree</b>	<b>Strongly</b>
<b>Disagree</b>				<b>Agree</b>

**6. The combination of visual presentation techniques used in the Set-SPECTRUM project, is crucial for understanding the essential elements of set design.**

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Strongly</b>	<b>Disagree</b>	<b>Undecided</b>	<b>Agree</b>	<b>Strongly</b>
<b>Disagree</b>				<b>Agree</b>

**7. I would like to use similar innovative computer-based products for educational purposes.**

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Strongly</b>	<b>Disagree</b>	<b>Undecided</b>	<b>Agree</b>	<b>Strongly</b>
<b>Disagree</b>				<b>Agree</b>

**8. Comments (Optional):**

.....

.....

.....

.....



.....

**Thank you for taking the time to complete this survey!**



## APPENDIX ELEVEN: THE SET-SPECTRUM PROJECT – INSTRUCTION FOR USE AND SYSTEM REQUIREMENTS

### Instruction for Use:

1. Open the Set-SPECTRUM PowerPoint Show.
2. Use hyperlinks or  (on your keyboard or screen) to navigate within the Set-SPECTRUM content.
3. Click  to open all media presentations ('Intro' and 'Animation').
4. Use hyperlinks to open 3D Model navigation window and 3D navigation 'Help Section'.
5. If asked 'Would you like to open this file?' while trying to open 'Intro' or 3D Model navigation window, press 'Yes'.
6. Use the 'Back' button only to come back to the main subsections and Main Menu.
7. In the 'Quiz' subsection, if you have answered the question correctly, you will be taken to the next one automatically.
8. Use the 'Esc' button to exit all media presentations ('Intro' and 'Animation'), 3D model navigation, and the Set-Spectrum project.

### System Requirements:

The following applications are required, in order to achieve the best performance of the Set-SPECTRUM Project:

- Microsoft PowerPoint (version 97 or higher)
- Windows Media Player (version 9 or higher)
- nVIDIA GeForce 6200 64M Video Card (or higher).